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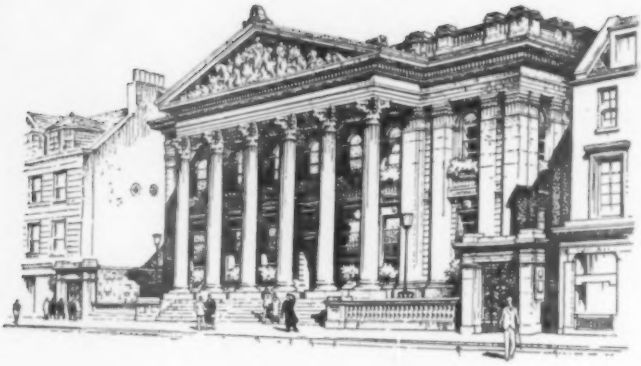

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THE SCOTTISH
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THE PARISH OF NORTH UIST

G. L. Davies

Forty miles to the west of the Scottish mainland, lying like a giant breakwater protecting the north-western coasts of Scotland from the full fury of the Atlantic gales, are the islands of the Outer Hebrides. The parish of North Uist * occupies a central position in this island chain, to the south of Harris and to the north of Benbecula. The parish is a part of Inverness-shire, and consists of the island of North Uist together with the many smaller islands that lie around its shores. While some of these small islands, such as Grimsay, Baleshare, Kirkibost, Vallay and Oronsay, are tidal islands, that of North Uist is linked to Benbecula at low tide when the extensive strand plain of the North Ford is exposed. Other islands included within the parish, such as Ronay, Boreray and Lingay, are insulated at all states of the tide, as are the now uninhabited isles of the Monach group which lie ten miles to the west of the island of North Uist.

In common with the other Outer Hebridean islands, North Uist is not easily accessible, and until the introduction of the air service from Renfrew to the Outer Isles in 1936 the journey from Edinburgh or Glasgow occupied at least thirty-six hours. To-day air transport places Benbecula within eighty minutes of Renfrew, although the final stage of the journey from Benbecula Airport to North Uist across the North Ford frequently takes two or three hours. At present Benbecula is served by four flights in each direction every week. Most visitors still travel by sea, however, and the steamer from Kyle of Lochalsh or Mallaig calls at Lochmaddy, the chief settlement in the parish, three times a week.

In 1951 North Uist had 2,221 inhabitants, and of this total about 82 per cent were members of crofting families, largely dependent on the land for their livelihood. Most of the land in the parish is very poor, however, and the crofts, as elsewhere in the Outer Isles, are too

* Hereafter the parish of North Uist will be referred to as North Uist, while the main island in the parish will be referred to as the island of North Uist.

small to support a family at anything but a very low standard of living, which many islanders have refused to accept. Instead they have joined the exodus from the Highlands and Islands and have moved to other parts of Britain or emigrated to more distant lands. As a result, the population of North Uist has declined steadily since the 1880s.

Physical Background

North Uist is formed entirely of Lewisian Gneiss which long continued erosion has reduced to a low-lying, gently undulating surface, and although there are a few hills in the northern and eastern parts of the parish, most of the land lies within 100 feet of sea level. The most striking feature of the topography is the enormous number of lochs that are scattered over the surface. Inland water in fact occupies 11 per cent of the area, and in the seventeenth century Martin Martin wrote of the parish, " There is such a number of Fresh-water Lakes here, as can hardly be believed, I my self and several others indeavour'd to number them, but in vain, for they are so dispos'd into turnings that it is impracticable." [1] Most of the lochs are shallow with extremely irregular outlines, and many, elongated in a north-west to south-east direction, probably occupy shallow depressions scooped out by the Quaternary ice sheets as they moved across North Uist from Skye and the mainland. The large number of lochs on the low-lying parts of North Uist, the indeterminate drainage of most of the parish, and the indented coastline with many off-shore islands, are all the result of the post-glacial submergence of the Outer Isles. Further evidence of this positive change of sea level is to be seen in the submerged peat which occurs at numerous places around the shores of North Uist, while many of the lochs which are now tidal preserve traces of their former freshwater life.[2]

Six morphological regions (see Fig. 1) can be recognised within the parish :

1. The Mamillated Lowland. A barren region whose surface is largely composed of heavily glaciated bosses and *roches moutonnées* ; the only surperficial deposits are the very thin accumulations of peat that lie in the damp hollows between the bare domes of gneiss.

2. The Glaciated ' Crags ' and their ' Tails '. The ' Crags ' are the hills that lie in the east of North Uist ; they are in fact giant *roches moutonnées* aligned in the direction of the ice movement, with gentle and slightly convex ice-swept south-eastern slopes, and steep and concave north-western or lee sides ; the latter form high cliffs on both Eaval and South Lee. At the foot of most of these steep north-western slopes there are great accumulations of boulder clay forming the ' Tails '. The size of the ' Tail ' depends on the height of the adjacent ' Crag ', and that of Eaval (1,138 feet), the highest, is half a mile long. The ' Tails ' have long, slightly concave slopes which, unlike the heights above them, are almost free from rock outcrops.

3. The Central Lowland. This low-lying region is an intricate interlacement of land and water. The whole land surface is blanketed by peat which is sometimes twenty feet thick, and the area has no economic value other than as a source of fuel for the islanders.

4. The Glaciated Hills. Included within this region are all the hills of North Uist which do not form a part of the eastern ' Crag and Tail ' belt. These hills

have smooth, flowing outlines with long, usually convex slopes on which rock outcrops are rare, and they thus stand in marked contrast to the ' Crags '. The slopes of the hills are comparatively well-drained, and they provide summer grazing for sheep and a few cattle.

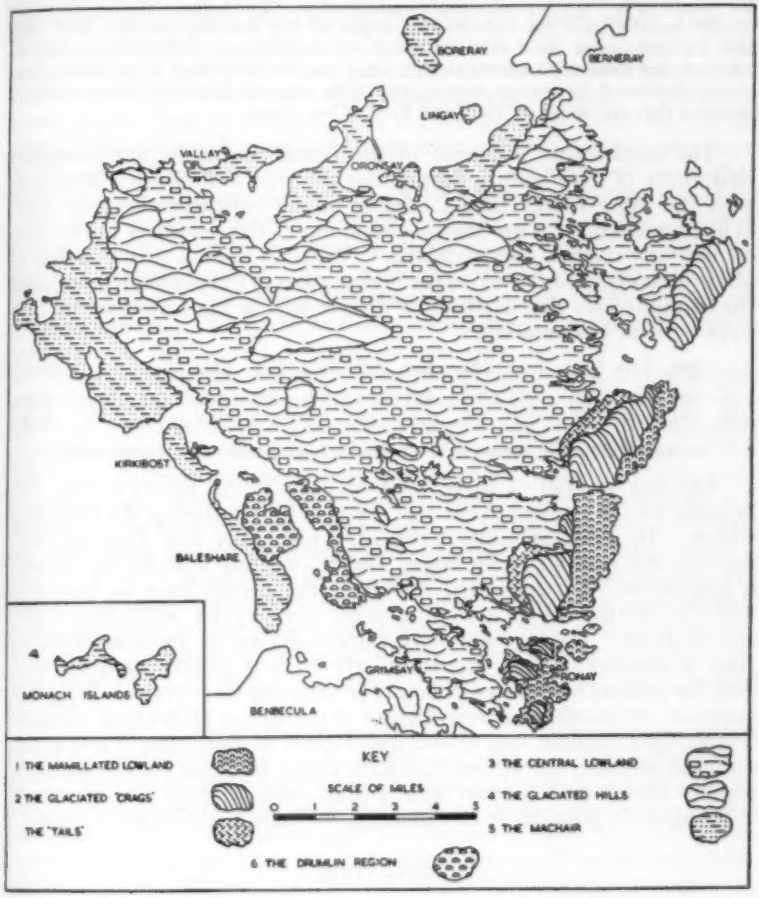

Fig. 1. Morphological Regions of North Uist. *(Crown Copyright reserved.)*

5. The Machair occurs along parts of the northern and western coasts and is composed of calcareous sand which has been blown inland off the adjoining beaches and which, in places, has accumulated to depths of over fifteen feet. It gives rise to two different types of topography. It usually forms a level plain such as is found in the west-coast townships of Balmore and Knockintorran, and in Clachan Sands, Oronsay and Machair Leathann on the north coast. In the townships of Tighary, Hosta and Baleloch, however, the sand forms a hummocky surface ; this appears to be developed as a result of the drifts accumulating around the features of a previously existing topography as occasionally the gneiss protrudes through the sand at the crests of the undulations. About 45 per cent of the crofting population of North

Uist lives within this region, for the sandy soil drains well, and when dressed with *Laminaria* seaweeds forms good agricultural land.

6. THE DRUMLIN REGION lies in the extreme south-west of North Uist. The drumlins, small (mostly about twenty-five feet high and fifty yards long) and isolated, are elongated in a north-west to south-east direction. The hollows between them are usually marshy, but the well-drained slopes of the mounds provide land suitable for cultivation. As a result of the recent submergence many drumlins now lie off-shore and form small islands at high tide ; some of these have been almost completely destroyed by marine erosion, and their remains form the low mounds of boulders that are visible on the North Ford at low water.

The moderating influence of the ocean results in a remarkable uniformity of temperature throughout the year and North Uist shares with the other Outer Isles a climate of the temperate oceanic type. Winter temperatures are higher and summer temperatures lower than on the west coast of the mainland.[3] With an annual precipitation of about 47 inches,[4] and over on the higher parts of the parish, is associated the characteristic fine Hebridean drizzle and a high number of rain days—260 at Lochmaddy.[5]

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Year
A.	5·0	4·0	3·7	2·8	2·4	2·5	2·9	3·9	3·7	4·5	5·3	6·0	46·7
B.	4·9	4·0	3·7	2·8	2·6	2·5	3·2	4·1	4·0	5·0	5·3	5·8	47·9

Average rainfall in inches : A.—Monach Lighthouse : B.—Lochmaddy.

The low rainfall of early summer permits the moors to dry sufficiently for the crofters to cut and dry peat for use during the following winter. If, as occasionally happens, April, May and June are wet months, the moors remain boggy and the cutting and drying of peat is impossible. In wet years, therefore, the people have to buy coal which in North Uist costs about £10 per ton—a price which the crofter can ill afford. The increase in the rainfall during the months following June is another climatic hardship—the harvest period is usually wet, and the crofters often have difficulty in securing their crops. Frequent gales are yet another adverse feature of the Outer Hebridean climate. Throughout autumn and winter quiet spells of more than a few hours duration are rare, and strong salt-laden winds, frequent even in summer, prevent tree growth ; apart from a plantation of about fifty trees in a very sheltered position at Lochmaddy, the parish is virtually treeless.

POPULATION

Little is known of the early history of the Outer Isles, but the large number of archaeological remains in North Uist indicates that it had a considerable population in pre-historic and early historic times. These remains include stone circles, chambered cairns, earth houses, brochs and duns, and there are no fewer than eighty-six examples of the latter within the parish.[6] There are, however, no structural remains dating from the period between about 900 and 1266 when the Western Isles were under Norse control. This absence is probably due to the fact that the Norse building material was usually wood,[7] but ample evidence of the Norse occupation is to be seen in the place names of the parish. The period of Norse domination ended in 1266 when Norway ceded the

Hebrides to Scotland. The Scottish king granted North Uist to the Celtic MacRuaris who retained the territory until 1346 when it passed into the hands of the MacDonalds.[8]

The history of North Uist during the days of the Clan system remains obscure, but when Martin visited the parish about 1695 he found a prosperous community. He wrote that the people "are generally well-Proportioned, of an ordinary Stature and a good Complection, healthful, and some of 'em come to a great Age."[9] Although some people then, as now, lived to a great age, the death rate at the time of Martin's visit must have been high. Epidemics of typhus and smallpox were of frequent occurrence, and Martin himself states that the latter disease swept through North Uist regularly once in seventeen years.[10] War must also have taken its toll of lives, for the people of North Uist were often engaged in warfare either with neighbouring clans or with the crown. As a result the natural increase must have been very small, and the population of the parish probably never greatly exceeded 2,000 persons before the second half of the eighteenth century.

In 1755, less than ten years after the passing of the various laws that destroyed the Clan system, Webster estimated that North Uist had 1,909 inhabitants.[11] The effects of the destruction of the Clan structure began to be felt in North Uist during the 1760s. The MacDonald chief, no longer interested in the welfare of his clan, was now only concerned with the amount of money he obtained from his people in the form of rents. Consequently in the 1760s he increased the rents of his tenants, or tacksmen, by at least a third.[12] This increase was felt to be unreasonable, and in 1770 a number of tacksmen on the North Uist estate formed a company, purchased 100,000 acres of land in South Carolina, and emigrated, taking with them most of their own tenants.[13] This appears to have been the first large-scale emigration from North Uist, and over 200 people left the parish between 1771 and 1775.[14]

This wave of emigration was short-lived, however, because of the rise of an important and prosperous kelp industry in North Uist during the 1770s. The first attempts at burning seaweed to produce kelp, which was an important source of iodine, soda and potash, were probably made here about 1735,[15] but the early efforts met with little success. By 1775, however, North Uist had become the most important kelp producing estate in the Western Isles. The average annual production was about 1,400 tons,[16] and the kelp was exported to processing factories in Glasgow and Liverpool. Most of the seaweed was collected on the east coast of North Uist during the summer while the people were at the shielings, and the writer of the old *Statistical Account* records that between the 10th of June and the 10th of August almost the entire population of the parish was engaged in making kelp.[17]

The kelp industry provided the people with an important new source of income. They no longer had to rely solely on the soil for their living, and the size of North Uist's population ceased to be limited by the amount of land available. The kelp boom probably also encouraged the birth rate to rise, for the larger the labour force possessed

by each family, the higher were its earnings from kelp making. A second factor which caused the population of North Uist to expand during the final years of the eighteenth century was the introduction of inoculation which brought about a fall in the death rate,[18] while the destruction of the Clan system put an end to the wars which had taken a heavy toll of lives. As a result of these influences the population of North Uist increased by 160 per cent between 1755 and 1821, when the parish had 4,971 inhabitants (Fig. 2). The feeding of this greatly increased population was made possible by the growing of potatoes, which had been introduced into the Hebrides in 1743,[19] and which soon became the staple food of the islanders as they gave higher yields than oats and other cereals.

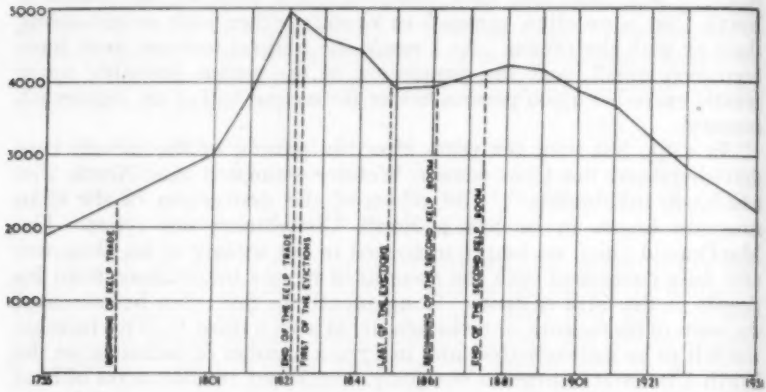

Fig. 2. Population of North Uist, 1755-1951

Until 1814 all the agricultural land in North Uist was divided into farms which were either rented by tacksmen who were often retired army officers, or held jointly by a number of tenants. The arable land within these communal farms was worked on the runrig principle, while all the grazing was held in common. In the years following 1814 Lord MacDonald carried out a series of land reforms on his North Uist estate, and these laid the foundations on which the present crofting system has been built. The communal farms now became townships, and were divided up into a number of small individual holdings or crofts, together with a large area of grazing land that continued to be held in common.[20] In the machair townships, however, although crofts were created, some of the arable land remained common and continued to be worked on the runrig principle.

These reforms brought about a great improvement in the agriculture of North Uist. The new individual holdings encouraged crofters to improve the land, for they had the security of knowing that, provided their leases were renewed annually, the land remained theirs, and would not be re-allocated every year as it had been when the runrig system prevailed. The reforms also contained the seeds of future

problems and discontent amongst the crofters, because they were carried out during the period of abnormal conditions when the kelp boom was at its height. At that time many families in North Uist held no land and made their meagre living by manufacturing kelp, but when the communal farms became townships the average size of each tenant's holding was reduced, and crofts were created for the landless families. New crofting townships were also established by reducing the areas of the tacksmen's farms. The number of holdings in North Uist was thus greatly increased, but most of the new crofts were very small and they were adequate only because the income derived from kelp production made the crofters partly independent of the land.

In the 1820s the kelp trade of the Western Isles collapsed when a cheaper source of soda was found in Spanish barilla.[21] For the first time for fifty years the crofters were forced to depend solely on the land for subsistence, and it soon became apparent that the North Uist crofts were too small to support a family. The overpopulation of the parish became a serious problem, and many people found it almost impossible to make a living. Conditions worsened after 1825, when Lord MacDonald, who was himself in financial difficulties as a result of the fall in the price of kelp, began to evict many of his North Uist tenants. He refused to renew their annual leases on the grounds that the crofters were in arrears with their rents, which was probably true, for the rents had been fixed at a time when the crofters' incomes were swollen by their earnings from kelp making, and what had been a fair rent in 1815 had become an extortionate rent by 1825. Many townships were cleared of their population between 1825 and 1849, and let to sheep farmers who were willing to pay high rents. Some of the evicted people moved to other townships in North Uist, but many of them left the parish, and some, it is said, were actually forced aboard emigrant ships and shipped to the colonies where they were landed penniless and homeless.[22]

As a result of the collapse of the kelp trade and the evictions, a wave of emigration began in the 1820s and continued for three decades. In 1828 alone over 600 people left North Uist bound for North America,[23] and the population declined by 21 per cent between 1821 and 1851, when the parish had 3,918 inhabitants.

The census of 1861, however, indicated that the population was again increasing. It continued to grow until the 1880s, and in 1881 the parish had 4,264 inhabitants, an increase of 9 per cent during the three decades following 1851. This small increase was due to a number of factors, probably the most important of which was the improvement of crop yields following the introduction of more modern methods of agriculture. Another important cause was a second kelp boom which affected North Uist between 1862 and 1875 as a result of the increased use of iodine.[24] During the years after 1851 it also became easier for the crofters to supplement their incomes with earnings from such work as road and pier construction, while the introduction of the steamer service to the mainland facilitated a seasonal migration of workers to other parts of Britain.

In 1891 it became apparent that North Uist's population had again

begun to decline. This decline has continued up to the present day and in 1951 there were only 2,221 people in the parish, a reduction of 48 per cent on the population of 1881 and a greater decrease than in any other Outer Hebridean parish. The decrease has occurred despite the fact that between 1898 and 1923 the Congested Districts Board and the Board of Agriculture purchased most of the farms that had been the scene of evictions, and re-converted them into crofting townships. The decline of population has taken place largely because the crofts are too small to support a family at a standard of living comparable with that to be found in other parts of Britain, and because, since the collapse of the second kelp boom in 1875 due to the importation into Britain of cheap iodine from Chile,[25] North Uist has possessed no major industry to provide work for the people and to give them a steady income to supplement their small earnings from the croft. The loss during the 1914-1918 war of 149 men, about 9 per cent of the male population, has also had a serious effect on the parish.

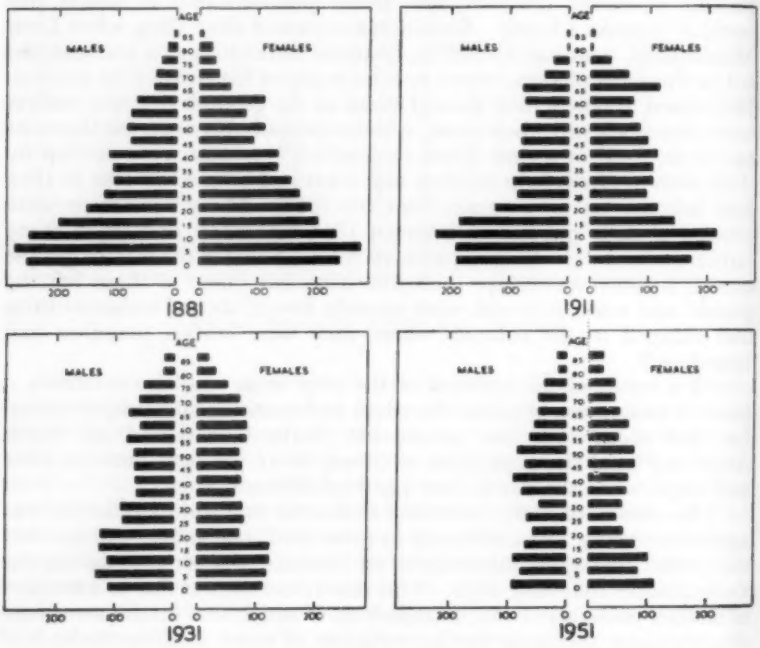

Fig. 3. Age structure of population of North Uist, 1881, 1911, 1931 and 1951.

In addition to declining during the last seventy years, the population has also aged as a result of the heavy war casualties and a steady drift of young people away from the parish because their parents' crofts are too small to provide them with work (Fig. 3). Most of those leaving North Uist settle in other parts of Britain, and very few of them ever return except for an occasional holiday, for once they have

become accustomed to the amenities of modern life they are unwilling to accept the poor living conditions to be found in the islands. The ageing of the population has resulted in a fall in the parish birth rate, and the number of deaths has exceeded the number of births during every five-year period since 1935. The unbalanced age structure of the present population is strikingly demonstrated by the fact that in 1951 there were 337 children attending schools in the parish, whereas there were no fewer than 354 people over the age of sixty-five drawing old age pensions.

North Uist To-day

To-day over 80 per cent of the inhabitants of North Uist are largely dependent on the land for their livelihood, and most of the people therefore live along the northern and western coasts, in the Machair and Drumlin Regions, where the best soils occur. The remainder of the population is found around the margins of the Central Lowland, either where the machair sand has been mixed with the peat to provide a soil that can be cultivated, or in areas where it has been possible to reclaim some of the peat moor. With the exception of Grimsay and Kallin, which are old settlements, all the townships standing on reclaimed land around the edge of the Central Lowland were established by people who had been forced to leave other parts of the parish, either through pressure of population or as a result of the evictions. Thus the township of Locheport was founded by people evicted from Sollas in 1849, while the original inhabitants of Knock-cuien came from Grimsay about 1900. As recently as 1923 the Board of Agriculture established the three townships of Lochportain, Cheese Bay and Hoe Beg to provide crofts for ex-servicemen and to relieve the pressure on the land in some of the older townships (Fig. 4).

The eastern side of North Uist is uninhabited apart from these recently established townships in the north-east, and Lochmaddy, the 'capital' of North Uist. Lochmaddy differs from the other settlements in the parish in that its 380 inhabitants do not depend on the soil for their living, for the town is a small commercial and administrative centre which has grown up at the point where boats from the mainland may most conveniently discharge their passengers and cargo. The absence of any further settlements in the east is due to the fact that soils are very thin or non-existent in the Mamillated Lowland and on the slopes of the 'Crags', while access to the eastern side of the parish is made difficult by the enormous number of lochs on the Central Lowland and by cliffs along the east coast.

There are to-day thirty-six townships in North Uist, each composed of a number of crofts together with a large area of grazing land which is held in common by all the crofters in the township. The number of crofts in each township varies greatly, and Stromban, the smallest, contains only three crofts, while Locheport contains thirty-four. All the townships have a sea frontage, and generally their boundaries run inland at right-angles to the coastline; each thus has a share of the various types of land, ranging from the better soils at the coast to the

poor peaty soils of the interior. Almost all are separated from each other by fences, and in most the poorest grazing land is fenced off from the rest of the township in order to keep the sheep off the best land during the summer. Most crofters are unable to meet the cost of fencing their holdings, however, and great difficulty is thus experienced in keeping the cattle out of the crops. In many townships the crofters solve this problem by taking it in turn to herd the animals for one day, but in others the animals are kept tethered to stakes.

Most North Uist townships are thrown open to the sheep and cattle in the winter after the potatoes have been lifted. The animals are then free to graze everywhere until the end of March, when the sheep are moved to the rougher pastures, the fenced crofts are closed, and the tethering and herding of cattle commences again. The actual dates for the opening and closing of a township are decided by a Grazing Committee which the crofters elect annually. In most townships this committee consists of three members presided over by a Clerk whose duties are many, and vary from filling in the agricultural returns for all the crofters in the township, to observing that no crofters keep more animals than they are entitled to. The maximum number of animals that each crofter may keep is known as the souming, and a typical souming for a North Uist croft is two horses, four cows, and fifteen sheep. Many crofters no longer keep two horses, however, and the Grazing Committee therefore allows them to exceed their souming of sheep or cows on the basis that two cows or eight sheep are equal to one horse.

In most townships that possess areas of fertile machair land, the greater part of the machair is held in common and cultivated on the runrig system. Under this system, as now operated, each crofter has only a small permanent holding, which, apart from a vegetable garden, is usually maintained as pasture. All the remaining machair within the township is divided into a number of unfenced fields known as scatts. One, two, or three scatts are brought into cultivation every three years, and divided into narrow strips or rigs, which are allocated to crofters by ballot. Each crofter usually holds about five rigs in different parts of the scatts, and on them he grows his crops. After three years the scatts that have been cultivated are allowed to revert to pasture, and remain as such for a long period while other scatts are brought into use. If the machair is not rested after three years under cultivation (or a shorter period if the years are dry), the sandy soil becomes subject to serious deflation and 'blow-outs' develop.

The runrig system enables the machair to be used to full advantage, for if the land in the machair townships was divided into a number of full-sized crofts together with a large area of common grazing, the valuable machair that formed the common would never be under crop, while the crofts would be too small for the land to be rested for a sufficient period after cultivation. The system is not without its defects, however, and perhaps the most serious of these is that the crofter has no incentive to improve the rigs, as he only holds them for three years at the most. Much land is also wasted in the paths that lie between the rigs, while a few crofters fail to use their strips, and they

soon become overgrown with weeds which spread to neighbouring rigs.

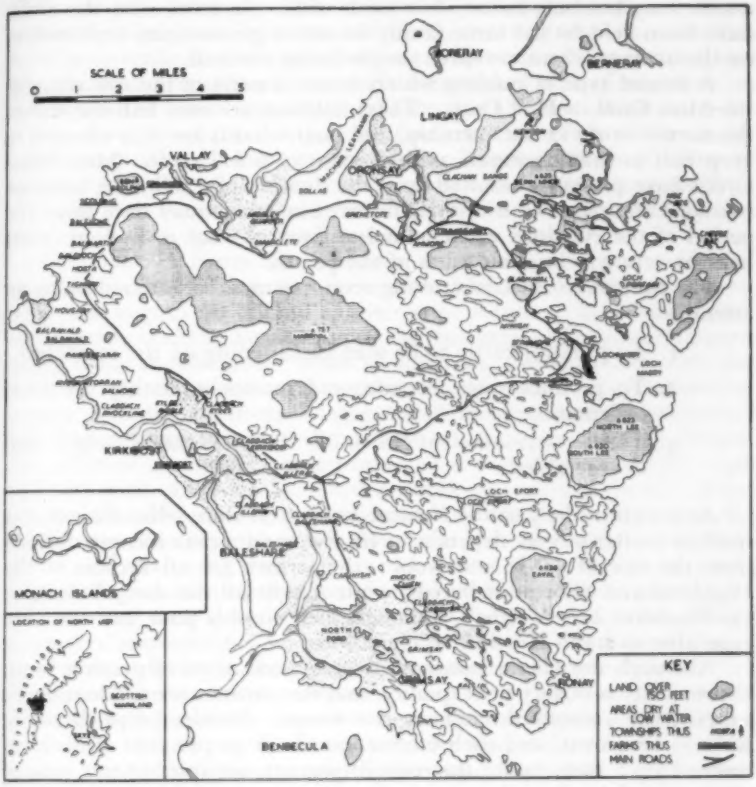

Fig. 4. North Uist—surface features and townships. (*Crown Copyright reserved.*)

The townships in which the runrig system is used usually have a different settlement pattern from the other townships in the parish. Where the runrig system is not operated the houses are usually dispersed, each standing on its own croft. In the runrig townships, however, where each man's permanent holding is only small, the houses rarely stand on the crofts, but tend to be clustered together, either along the road or on land that for some reason is less suitable for agriculture.

The thirty-six townships of North Uist contain about 550 crofts which vary in size from five acres in Grenetote, to as much as thirty acres on the poor land of Claddach-baleshare. The crofts within each township are usually all of a similar size, the average North Uist croft having an area of about twelve acres. In many cases the crofts, like the townships, form strips running inland from the coast, so that each

contains a variety of soil types. Many are thus long and narrow, and in a crowded township such as Grenetote, a croft may be half a mile long but only twenty-five yards wide. In most cases the crofts have been held by the same family for many generations, and to-day, on the average, there are three people living on each.

A second type of holding which exists in some of the townships is the Moss Croft or Half Croft. These holdings are only half the size of the normal crofts in the township, and their tenants are only allowed to keep half as many animals as the tenant of a full croft. Most Moss Crofts have probably resulted from the division of a full croft between two sons after the death of their father, but others may date from the period of the evictions when homeless families went to live on crofts held by relatives in other parts of the parish.

The present North Uist crofting economy may be summed up as an attempt—

1. To produce cattle to be sold for fattening on the mainland.
2. To produce wool for sale, and mutton to satisfy the local demand.
3. To be self-sufficient in milk, butter, cheese, eggs and vegetables.

Although in the past the North Uist crofters were self-sufficient, the modern crofter largely depends for his living on a cash income derived from the sale of cattle and wool : the former are all a cross of the Highland and Shorthorn breeds, while almost all the sheep belong to the Blackface breed, which, although their wool is poor, are the only type able to stand North Uist conditions.

Although the parish possesses about 47,000 acres of grazing land, the majority is of very poor quality, and the pastures are inadequate to support the animals throughout the winter. Fodder crops therefore have to be grown, and each crofter has about 50 per cent of his land under crop : oats, by far the most important, occupies 57 per cent of the cropped land in the parish; barley, grown on the well-drained machair land, only 4 per cent; mixed oats and barley, the two other principal crops, 8 per cent; and hay 22 per cent. In addition to these crops, most crofters have about half an acre of potatoes and a small vegetable garden.

Cattle sales are held in the parish in May and September, and they are attended by buyers from the mainland. Most crofters sell two or three animals a year, but the prices are usually low because of the high cost of transportation to a mainland railhead, and because the buyers know that the crofters have no alternative to selling their beasts. Wool is sold direct to the Wool Marketing Board, but as its quality is poor, the prices paid are again low. The average annual income that a North Uist crofter derives from the sale of wool and two or three cattle, and from the Hill Cattle and Hill Sheep Subsidies, and other grants, probably only amounts to about £85. The croft alone is thus insufficient to support a family, and the crofter therefore needs some part-time work to provide him with a second source of income.

This is even more true of the cottars who are found in many North Uist townships. There are about thirty cottar families in the parish to-day, most of them probably established during the period of the evictions, when unevicted townships allowed a few of the homeless families to settle on their own common. The cottars are entitled to a quarter of an acre of land, for which they pay an annual rental of ten shillings to the township's Grazing Committee. Most cottars keep one or two cows, for which they pay the Grazing Committee at the rate of ten shillings for each beast grazed on the Common, and a few hens to supply them with eggs. Their only cash income is from the sale of one, or at the most two stirks each year and thus like the crofters, they must have an income apart from that derived from the land.

For many in North Uist the most important secondary source of income is lobster fishing, and the crofter-fishermen often neglect their crofts and regard the fishing as their chief means of livelihood. The wide, gently shelving beaches along the exposed northern and western coasts make it difficult for boats to approach the shore and only the crofters of the townships in the north-east and in the south can therefore engage in fishing, for in these regions the rocky coastline of the Central Lowland provides many small inlets which make admirable harbours. The lobsters are caught around many of the rocky islets off the coast of North Uist, although the chief grounds are off the Monach Isles. Most of the catch is sold in Billingsgate, London, but transport to the market is a serious problem, for the crofters are only paid for lobsters that arrive alive, and, especially in hot weather, large numbers fail to survive the two or three day journey to London. Some crofter-fishermen now sell their lobsters to the Crofters' Supply Agency Ltd, which takes over responsibility for marketing the catch. The Agency keeps some of the lobsters in the ponds at Stockinish and Bernera in Harris-Lewis until the market is ready to receive them, while on the way to London the lobsters are dipped in sea-water troughs at Oban for refreshment. Many problems of marketing Outer Hebridean lobsters remain unsolved, however, and the proposal was recently made that the North Uist fishermen should charter an aeroplane and fly their catch from Benbecula to London. The scheme was abandoned when it was found that to be economic each plane's cargo had to be about five tons of lobsters, and there was a grave risk that such a large quantity would cause a glut on the market and greatly reduce the selling price.

The existence of the fishing industry has led to the establishment of a number of attendant trades, the most important of which is boat building, a firmly established industry, especially in the island of Grimsay, where it employs about a dozen men. The second most important ancillary occupation in North Uist was, until recently, the manufacture of tweeds. The weaving was done in the crofters' homes, and in 1948 the majority of the townships contained at least one loom. In 1947 a spinning mill was opened at Lockeport which could employ twelve men and supply the North Uist weavers with 4,000 pounds of yarn per week. The mill has rarely worked at full capacity, however, and following the imposition of a 66⅔ per cent purchase tax on tweed in

1948, the industry of North Uist collapsed, and very little tweed is produced in the parish to-day.

Other part-time occupations in which crofters and cottars find employment are very varied. Some are bus drivers, postmen, and ferrymen, and about twenty men work in road-repair gangs during the summer after they have finished carting home their peats and before harvest time. A few girls go to work in hotels on the mainland during the summer, but there is very little seasonal migration of workers to the mainland because almost all the young people who are not required to work the crofts live permanently away from the parish

An important supplement to many crofters' incomes is money regularly sent to them by relatives and grown-up children now living outside North Uist. Other crofters appear to be making use of money they saved when they were working elsewhere in Britain or abroad before they inherited their holdings.

In addition to the thirty-six crofting townships in North Uist, there are six farms, together with a few small independent holdings outside the townships. Sóme of the farms, such as Griminish and Scolpaig, were originally townships from which the people were evicted, but others, like Kirkibost, have always been farms, while Balranald was formed out of three crofts in 1943. The farms vary greatly in size, but all of them except Balranald have as their prime object the production of store cattle for the Oban sales. Kirkibost, which is composed entirely of machair pastures, has the largest stock of cattle, and the farmer rents the Monach Isles, which have been uninhabited since 1943, and Vallay for grazing purposes. Like the crofters, the farmers find it necessary to grow fodder crops and each farm has a considerable acreage under oats and other crops. The small Balranald farm is owned by the Department of Agriculture, which uses it for experimental purposes and for demonstrating new methods of agriculture to the crofters. The North Uist farms are unimportant as employers of labour, for they only provide employment for twenty full-time workers.

The Future

North Uist will receive a new industry this year (1956), when Alginate Industries Ltd open a factory at Lochmaddy where seaweed, which possesses many organic constituents of value to industry, will be dried and milled before shipment to the mainland for processing. This firm has for a number of years operated a similar factory in South Uist, and the new plant at Lochmaddy will provide employment for about eighteen full-time workers and fifty part-time seaweed collectors. North Uist has great resources of seaweed, for Loch Maddy and Loch Eport alone contain 33 per cent of Scotland's littoral seaweed,[26] and many people in the parish hope that, as in the past, a seaweed industry will bring prosperity.

Work is also scheduled to start this year on a causeway across the North Ford to link North Uist with Benbecula. It is estimated that this will cost £250,000, but when completed the two Uists will be linked by road, for a causeway has already been built across the South

Ford between Benbecula and South Uist. The causeway will lessen the isolation of North Uist and make it part of a larger community. In 1951 the total population of the parishes of North and South Uist (Benbecula is a part of South Uist parish) was 5,986 persons, and when the new causeway is completed the combined populations of the two parishes will probably be large enough to support a number of amenities and social services that hitherto the population of each parish individually has been too small to maintain.

Another development which will increase the importance of the Uists is the establishment of the proposed guided-missile rangehead at Geirinish in South Uist. When the scheme is carried out, as many as 1,500 servicemen may be stationed in Benbecula during the peak training period, while a few will be stationed on the small air-strip at Sollas in North Uist, which it is proposed to re-open. These service personnel will provide the crofters with a market for eggs, vegetables, and other croft products.

Despite these developments, however, it appears probable, in view of the unbalanced age structure of the population of North Uist, that unless there is some migration into the parish, the population will continue to decline for some decades. Eventually the number of crofts in the parish will greatly exceed the number of crofting families, and it will then be possible for each family to hold several crofts, and thus possess a sufficient acreage to support themselves at a reasonable standard of living. Some crofters already possess more than one croft, and in the island of Baleshare, where the population has declined from 383 persons in 1901 to 75 persons in 1951, some crofters hold as many as eight crofts, and are in effect small tenant farmers. Baleshare provides an indication of what may be expected to happen throughout North Uist within the next few decades.

The author gratefully acknowledges the assistance he received from many crofters and others in North Uist, from Mr C. A. Cameron of Alginate Industries Ltd, South Uist, and from officials of the Department of Agriculture and New Register House, Edinburgh.

[1] MARTIN, MARTIN, *A Description of the Western Islands of Scotland*, London, 1703, p. 57.

[2] JEHU, T. J. and CRAIG, R. M., Geology of the Outer Hebrides Part III—North Uist and Benbecula, *Trans. Roy. Soc. Edinb.*, 1923-1926, 54 : pp. 471, 473.

[3] The nearest meteorological station to North Uist with complete records is Stornoway (Lewis), and the mean annual temperature range there is only about 14·8°F. The highest temperature ever recorded in the town is 78° F.—see MANLEY, GORDON, The Climate of the Outer Hebrides in Fisher, J. (Ed.). *The New Naturalist*, London, 1948, pp. 80 and 81.

[4] Statistics for Lochmaddy and the Monach Isles kindly supplied by the Meteorological Office, Harrow.

[5] Average calculated from the yearly totals recorded in the annual Meteorological Office publication *British Rainfall*.

[6] BEVERIDGE, ERSKINE, *North Uist Its Archaeology and Topography*, Edinburgh, 1911, p. 132.

[7] Royal Commission on Ancient and Historical Monuments and Constructions of Scotland, *Ninth Report with Inventory of Monuments and Constructions in the Outer Hebrides, Skye and the Small Isles*, Edinburgh, 1928, p. xxiii.

[8] BEVERIDGE, E., *op. cit.*, pp. 24, 25.

[9] MARTIN, M., *op. cit.*, 1703, p. 78. [10] *Ibid.*, p. 75.

[11] KYD, J. G. (Ed.), Scottish Population Statistics Including Webster's Analysis of Population 1755. *Scot. Hist. Soc.*, 3rd Ser., 1952, 44 : p. 60.

[12] SINCLAIR, JOHN (Ed.), *The Statistical Account of Scotland*, Edinburgh, 1794, Vol. 13, p. 317.

[13] MACLEOD, R. C., *The Island Clans During Six Centuries*, Inverness, 1930, p. 116.

[14] SINCLAIR, J., *op cit.*, p. 317.

[15] GORDON, SETON, *Afoot in the Hebrides*, London, 1950, p. 311.

[16] MACCULLOCH, JOHN, *The Highlands and Western Isles of Scotland*, Vol. 3, London, 1824, p. 116.

[17] SINCLAIR, J., *op cit.*, p. 306. [18] *Ibid.*, p. 312.

[19] SALAMAN, R. N., *The History and Social Influence of the Potato*, Cambridge, 1949, p. 358.

[20] *The New Statistical Account of Scotland*, Edinburgh, 1845, Vol. 14, p. 174.

[21] MACKENZIE, W. C., *History of the Outer Hebrides*, Paisley, 1903, p. 549.

[22] *Evidence Taken by H.M. Commissioners of Inquiry into the Condition of the Crofters and Cottars in the Highlands and Islands of Scotland*, Edinburgh, 1884, Vol. 1, p. 801.

[23] *The New Statistical Account of Scotland, op cit.*, p. 171.

[24] MACRURY, EWEN, *A Hebridean Parish*, Inverness, 1950, p. 11, and also Mackenzie, W. C., *op. cit.*, p. 549.

[25] MACKENZIE, W. C., *op cit.*, p. 549.

[26] JACKSON, PHILIP, Scottish Seaweed Resources, *S.G.M.*, 1948, 64 (3) : p. 137.

SAMUEL CLARK CLAPPERTON

By the death of Mr S. C. Clapperton on the 12th of May 1956, the Society has lost a trusted servant and valued friend. Appointed Treasurer in November 1946, he kept the financial books and records with the accuracy and care expected of one whose professional career had been distinguished in banking. In this work he no doubt found much to interest him in his years of retirement, but he found much more. The duties that were his became an absorbing and satisfying hobby and a labour of love. The officials were of course best placed to appreciate the promptness and amplitude with which he answered their requests for information about the Society's affairs and it was with much concern they watched his endeavours, as his last illness cast its shadow over him, to keep his books right up to the final entry. Fortunately for him release came soon, but to his wife and three daughters who survive him, we offer our respectful sympathy in their bereavement.

A. B.

THE LÖSCHIAN LANDSCAPE: A REVIEW

C. J. Robertson

On the borderlands between economics and geography, in a broad zone that gives promise of much fruitful work, August Lösch (1906-1945) was a pioneer. There was a relatively long tradition among German economists in the study of location theory, a tradition extending back, at least as regards the subsequent influence of his work, to the publication in 1826 of J. H. von Thünen's *Der isolierte Staat in Beziehung auf Landwirtschaft und Nationalökonomie*. More direct in its influence on work outside Germany has been Alfred Weber's *Ueber den Standort der Industrien*, published in 1909 but not available in an English translation until 1929. The time-lag for the wider availability of the work of Lösch has been somewhat shorter. *Die räumliche Ordnung der Wirtschaft* was published in 1940. The present American edition is translated from the second German edition of 1943 but incorporates some material from the first.[1]

To a greater extent than his predecessors Lösch endeavours to establish the theory of location on both the agricultural and the industrial sides on a broader basis and to relate it to other branches of economic theory, especially to the theory of international trade, though Ohlin had already devoted particular attention to this last link. Professor Wolfgang F. Stolper, in his introductory note on the author, reminds us that Lösch was " the first to present a full general equilibrium system describing in abstract the interrelationships of all locations ". On its first publication this work met with considerable criticism but some of the controversy is already dated and may have an interest only for the economist concerned with the history of economic theory. Lösch recognises the high degree of abstraction involved in the attempt to secure the maximum applicability of his theory but himself provides much realistic material. He has been criticised for not using this material adequately and indeed much of it is relegated to the last part of the book as ' examples ' or to the lengthy footnotes. A more sustained historical approach would probably have enabled theory and factual analysis to illuminate each other more effectively. It is only fair to add, however, that Lösch himself considered, though there is only a brief reference (p. 259), that, while broad generalisation is relatively easy on a very wide scale, the part played by differences in historical development is more difficult to assess when small regions are studied.

Choice of location is first discussed from the standpoint of individual enterprises. There is a demonstration of the transport cones round a punctiform market, the basic abstraction of agricultural location theory. While von Thünen's ' rings ' round such a market related to highly abstract and indeed fantastic conditions, depending on transport costs alone, Lösch prefers to regard the rings as expressing decrease in

weight of output per unit area from the centre to the periphery, where the poorer soils may be completely abandoned. Like von Thünen's original version of the rings, that of Lösch is still a highly simplified one.

We pass on to industrial location, which is on the whole treated rather more realistically. Following on the work of Christaller and other geographers on the patterns of urban settlement—only briefly mentioned in footnotes—Lösch investigates the theoretical pattern of location in general. Starting with the assumption of a plain and abstracting from all factors—for example, terrain, soil, climate—that would invalidate its uniformity, he takes a honeycomb of hexagons as the ideal economic network, since it leaves no interstices in covering the surface, would require the minimum area to realise a given total demand and make possible the maximum number of independent enterprises. Considerable space is devoted to mathematical discussion of this spatial pattern.

Industrial location is regarded as a compromise between the economies of large-scale production and the costs of transportation, in other words, the equilibrium resulting from the maximisation of advantages by the individual firm and the maximisation of individual enterprises that might result from competition. Lösch relates this competition to the filling-in of any gaps in the hexagonal pattern of the industry, taking illustrations from the cement industry in the United States. But it has been pointed out (by Ritschl for instance) that new firms frequently prefer to set up in the same location as the existing firms and in fact Lösch himself points out the crowding to such locations of small enterprises, which depend on external economies to a greater extent than the larger.

Superimposed nets of hexagons with a common centre—Christaller's " central sites "—may be turned around so that there are six sectors with many sites, each with many branches of production, and six sectors with few sites, each with no more than a few branches of production. With this cogwheel arrangement the maximum number of locations coincide ; the sum of the minimum distances between industrial locations is least, so that transportation lines are reduced to a minimum ; the maximum number of purchases may be made locally. This theoretical economic landscape is in most cases far from reality but, nevertheless, as a standard of comparison it helps to an understanding of actual areal patterns. Traffic lines radiating from some large centres appear to conform to the theoretical pattern—Lösch instances the main railway lines from several large cities. Though in one place (p. 215) Lösch states that " in reality market areas are like irregular pieces of slate carelessly flung down ", his general attitude toward these theoretical patterns is coloured by his belief that they are not as far removed from reality as might be at first sight imagined, since all the organising forces combine against the separate chaotic ones. Here, surely, the beneficent shadow of Adam Smith's ' hidden hand ' reminds us of Lösch's general assumptions.

Lösch endeavours to set up a theoretical framework of all locational interrelationships. He recognises that the individual units of pro-

duction and consumption, the producing centres and markets, the distribution of urban and rural population, the lines of transportation and so on are so closely interrelated that they together form a *Gestalt*. Were it practicable, however, to take into account all the factors besides distance, advantages of large-scale production, competition, the result would be an indefinite number of such individual structural wholes. To reconcile with the results of observation a theory of economic regions having some general validity allowance can be made for only a few modifications of the general assumptions, which are reduced to a minimum in number and therefore to a maximum of generality. His economic regions are thus only "simplifying spatial constructs" (p. 275).

The theory does not necessarily explain the facts since to take in all the facts may be, as Lösch says, "humanly impossible". There are, in fact, too many variables. While the uncertainties of judgment by individual entrepreneurs may cancel out in the long run, some locations are irrational on economic grounds and increasingly so with greater government intervention on strategic, political and social grounds. Thus the theory, as an economic theory, is not necessarily wrong even if it does not 'fit the facts', rather it becomes a normative basis of action. The practical problem of planning is to choose the best compromise between the theoretical norm and the historical and geographical reality. As Lösch puts it (p. 81), "in determining a site the best location theory can do is to suggest the locations to be examined". He has no illusions as to the results. There are so many alternatives that the completely rational and purely economic choice is unlikely to be made and dynamically there is no best location because we cannot know the future (p. 16), so we might as well go back to the comparative study of actualities.

Lösch proceeds logically to a discussion of the theory of international trade since this is a part of the general theory of location. In international trade the locational division of labour takes over supremacy from the occupational and the personal division of labour. Lösch criticises a well-known generalisation of Zimmermann (1918) that world trade would with further economic development increasingly follow the lines of longitude rather than those of latitude. Lack of mobility of natural or cultural factors and lack of divisibility—in other words the advantages of large-scale production—are more clearly seen when the hierarchy of market areas is considered on the world scale. The indefinite enlargement of market areas is limited, however, not only by political divisions but in most cases by there being no need for extremely large market areas. There is an interesting section on the way in which the world market for wheat was divided among the great exporters in 1928-29 before government intervention on the large scale had begun. Wheat prices are used (pp. 188-189) to illustrate the formation of economic regions. Price funnels or price cones are prominent features in the Löschian landscape, their size and shape related to the locational hierarchy. The last two chapters open up wider aspects of price distribution and are amongst the most stimulating in the book.

The work of Lösch not only consolidated much of that of his predecessors but broadened the general theory of location in the general equilibrium framework. The possibilities and limitations of that approach have thereby been clarified. Location theory is now caught up in the movement toward a more dynamic economics, but the difficulties of a dynamic formulation are great. Lösch remarks that " most theorists are even less inclined to think in terms of space than the practical man " (p. 402). But since he wrote much further work has been done, both by the economic historians and by the students of 'space economy', notably in the United States. Wider acquaintance with the work of Lösch through its English translation is timeous.

This is the kind of book that has to be read and re-read, not only because of its valuable material but because it continues a tradition, notorious in this field, of involved and frequently obscure style. Professor Stolper, who has advised the translator, admits the need for some streamlining of the author's difficult formulations, some of which are obscure not only because of the convolutions of the original German phraseology but because of the high degree of abstraction in some sections. The present reviewer suspects that he will not be alone in finding some of the text incomprehensible and some of the diagrams inadequately explained. There are also some chapters that look like a few paragraphs of unfinished sections, others that consist mainly of vague generalisations, moral rather than economic. On the other hand, there are many useful footnotes, with the additional advantage of drawing the attention of English readers to the large German literature on the subject and particularly to the work of the Institut für Weltwirtschaft in Kiel, to which Lösch was attached in the last years of his short life.

[1] *The Economics of Location.* By AUGUST LÖSCH. Translated from the 2nd Revised Edition by William H. Woglom with the assistance of Wolfgang F. Stolper. 9½×6¼. Pp. xviii+520. 102 figures. 47 tables. New Haven : Yale University Press. London : Geoffrey Cumberlege, Oxford University Press. 1954. $7·50. 60s.

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RATTRAY: A STUDY IN COASTAL EVOLUTION

KENNETH WALTON

THE windswept mist-shrouded coastline of North East Scotland, exposed to the waves and gales of the North Sea and the Moray Firth, presents a succession of sandy bays and intricately sculptured cliffs cut in metamorphic, igneous and sedimentary Palaeozoic rocks; in a less remote part of the country, it would probably attract numerous tourists since the scenery is comparable with the best in the British Isles. The coastal strip of Aberdeenshire has, however, long been attractive to farmers and fishermen since the convergence of two contrasting environments offered, in the past more than at present, the opportunity of a dual livelihood from the land and the sea when agriculture alone provided but a poor and precarious means of subsistence. Although modern economic and technical changes have tended to concentrate the fisher population into larger seaports where facilities for coaling and oiling vessels and marketing of catch may be more easily supplied, in the historic period each small bay or narrow inlet of the cliff-coasts supported a fishing village. It might be expected that the sandy sections of the littoral would be less suitable for settlements owing to the difficulties of landing on a surf-beaten exposed shore; an examination of the map of Aberdeenshire would indeed reveal very few such settlements, with the notable exception of the twin settlement of Inverallochy and St Combs.

The modern map does not however give the whole picture. There exists a great deal of archaeological and historical evidence which shows quite clearly that the sandy coasts once had in fact quite a dense population. On the Sands of Forvie at the Ythan estuary, for instance, evidence of a large pre-historic community living on what is now a wilderness of sand dunes, the haunt of eider duck, terns and oystercatchers, is increasingly being uncovered, and there was almost certainly continuity of settlement here through the Dark Ages into medieval times. The Ythan Estuary was not, however, unique in this respect. On the sandy coast between Fraserburgh and Peterhead, although the picture is at present more obscure for the pre-historic period, there is a wealth of physical and historical data which permits a clear unfolding of the story of medieval Rattray and the Loch of Strathbeg. It is a story that demonstrates the close interaction between the evolution of the coastal environment and of human affairs.

The coastal district between Peterhead and Fraserburgh, of which this paper is a preliminary survey, consists of a glaciated lowland which, though differentiated in relief, rarely rises over two hundred feet above sea level. The underlying rock—gneiss with occasional granite and quartzite outcrops—is, for the greater part, masked by the ground and terminal moraines of the Moray Firth ice sheet which left its end moraines to the south-east of Fraserburgh, and by those of the Strathmore ice which spread far up the coast of Aberdeenshire to the vicinity

of St Fergus, where terminal moraines and the characteristic red tinge of the boulder clay are clearly visible. Associated with these ice sheets are outwash deposits which provided a great deal of the sand with which the coast is encumbered. Late- and post-glacial changes in sea level have left a clearly defined series of raised beaches cut in the rather soft and easily eroded glacial deposits so that a section from the ill-drained peat-covered districts of the immediate hinterland descends to the coast in a series of well-defined steps. These raised beaches make up the greater part of the coastal environment. On them has accumulated deposits of sand blown from the foreshore so that the coast is now fringed by dunes in various stages of fixation, while the impounding of small burns and the seepage of ground water behind them has created small lakes parallel to the coastline.

The outline of the coast, a series of sweeping curves hinging on low rock forelands, such as Rattray Head, Inzie Head and Scotstown Head, represents the attempts made by wind and wave action to align the shore in response to the dominant wave direction. Each of the bays terminates, cusp-like, at a partly submerged rock platform which bears indications of ice movement in the form of striations ; in the immediate vicinity are accumulations of rounded boulders which are probably the remnants of washed-out ground moraine. The present plan of the littoral, however, bears little relation to that in late-glacial and early post-glacial times. Some nine miles north of Peterhead, the bay between Rattray Head in the south and Inzie Head in the north is most interesting in this respect (Fig. 1). It is the result of the gradual enclosure of a deep indentation of the coast in late-glacial times, culminating in a smooth dune-fringed littoral behind which is now impounded the freshwater Loch of Strathbeg.

The former shorelines of the Rattray area (Fig. 1), now visible as degraded fossil cliffs in soft glacial and estuarine deposits, permit a reconstruction of the changing environment of this district. There are some indications of a higher sea level than that indicated by the fossil cliff-lines but the evidence is fragmentary. At various localities, as near the Mill of Crimond, there are old gravel pits, now grassed over, but it has not yet been determined whether they are fluvio-glacial or marine in origin. At similar elevations, roughly seventy-five to one hundred feet above sea level, borings for wells have revealed blue clays indicative of cold-water conditions ; whether these are freshwater or marine deposits is not yet known. The morphological evidence is even more restricted and while it is reasonable to assume that the hundred-foot beach is represented in this neighbourhood, there is no absolute proof of its existence as far as present research has shown. It is possible that the break of slope about seventy-five feet above O.D. in the vicinity of Cairness House marks the presence of this highest sea level and a former shoreline has been tentatively indicated here in Figure 1.

There is, however, much clearer evidence of a sea level about fifty feet higher than at present. At various localities degraded fossil cliffs cut in glacial deposits and often with blown sand long-fixed by vegetation on the top, are plainly visible both on air photographs and in the field. On a height basis, but without stratigraphical evidence, the sea

which left its mark on the coastal landscape has been correlated with Yoldia stage of the evolution of the Baltic. From the remnants of old shorelines, the coastline in Yoldia times has been reconstructed (Fig. 2). It shows that the Rattray area at this stage consisted of a large bay near the southern end of which were small islands probably formed of boulder clay left by the ice sheet which produced the striations on the rocks of Rattray Head. These islands, now capped with old grey dunes as above Old Rattray and Middleton of Rattray (Fig. 1) or by the policies

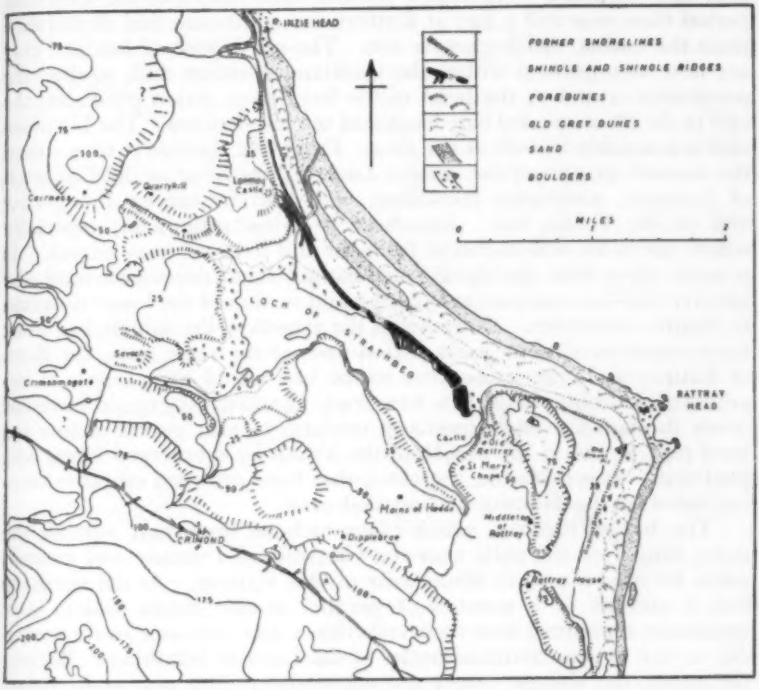

Fig. 1. Coastal features in the vicinity of the Loch of Strathbeg.
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and gardens of Rattray House, have steeper slopes on the seaward side where the brunt of the wave attack was experienced ; in their lee, deposits accumulated in the form of mud and sand banks. On the northern promontory of the bay there is a feature which may represent the degraded remains of a small southward-extending spit. At the head of the bay the small-scale relief features and soil near the Crofts of Savoch suggest a sandy delta encroaching into the sea. Erosional forms are, however, much clearer than the depositional features and the margin of the fifty-foot sea is plainly visible south of Rattray near St Fergus, where it forms an old cliff-line along the base of which runs the main road from Peterhead to Fraserburgh.

Although, as the classic section by Jamieson [1] at the mouth of the Ythan clearly shows, a fall of sea level followed the conditions described above, the next stage represented at Rattray is that of the sea standing about fifteen feet above O.D. There is little doubt that this cliff-line represents the margin of the Littorina Sea, of which the so-called twenty-five-foot beach is such an important feature along the east coast of Scotland. It is represented at Rattray by the erosional cliff-line with the beach in front and the bar which gradually extended south from near the Castlehill of Lonmay. In the early stages of the Littorina period there was still a bay at Rattray though its size had diminished since the earlier cliff-lines were cut. The old islands of boulder clay are now incorporated within the mainland coastline and, against the promontories and at the head of the bay, wave action produced the cliff in the estuarine and bay deposits of the fifty-foot sea. The Littorina cliff is a notable feature of the area. From Old Rattray it runs round the western margin of the present Loch of Strathbeg to the Castlehill of Lonmay, sometimes coinciding with and freshening the earlier cliff of the Yoldia Sea. Elsewhere it is less prominent, especially where the coast was sheltered from the full force of wave attack. It is quite clear that the shingle bar cannot have developed until the interior cliff-line was cut, as the left-hand section of the lower diagram in Figure 2 indicates. Nevertheless the growth of the shingle bar must have commenced at an early period and, at the same time, the Burn of Rattray and other tributaries to the bay would have begun to re-adjust their profiles to the new base level. Earlier, they would have cut down through the bay deposits to conform to that period of low sea level represented at the mouth of the Ythan by submerged forest and peat beds. It is probable, therefore, that their drowned estuaries were aggraded by the deposition of silt and mud.

The bar of Rattray, which plays such an important part in the story, hinges on the cliffs near the Castlehill of Lonmay and extends south for over a mile to the vicinity of Old Rattray. At the northern end it consists of a number of parallel shingle ridges which later terminate, sometimes with recurved ends, a short distance to the south-east of the present artificial outlet of the Loch of Strathbeg. Beyond this point the shingle ridges are consolidated into one main ridge, broken in its central section presumably by the action of storm waves. South-east of this modified section a number of laterals recurve towards the west while the extremity of the main bar has also been deflected in the same direction. Shingle is also found at the foot of the fossil cliff near Old Rattray, with a gap about fifty yards wide between it and the main shingle bar. The material from which the bar is derived undoubtedly originated from the boulder clay deposits of Inzie Head and was swept south by wave action. At intervals waves from the south-east deflected the free ends of the ridges, while the recurrence of normal wave conditions allowed a further southward development of the main ridge. Whether the lagoon which formed behind the shingle bar was ever completely sealed from tidal action is doubtful. The lowered central section of the bar was probably washed over by storm waves coinciding with spring tides, and the sluicing effect of the ebb would

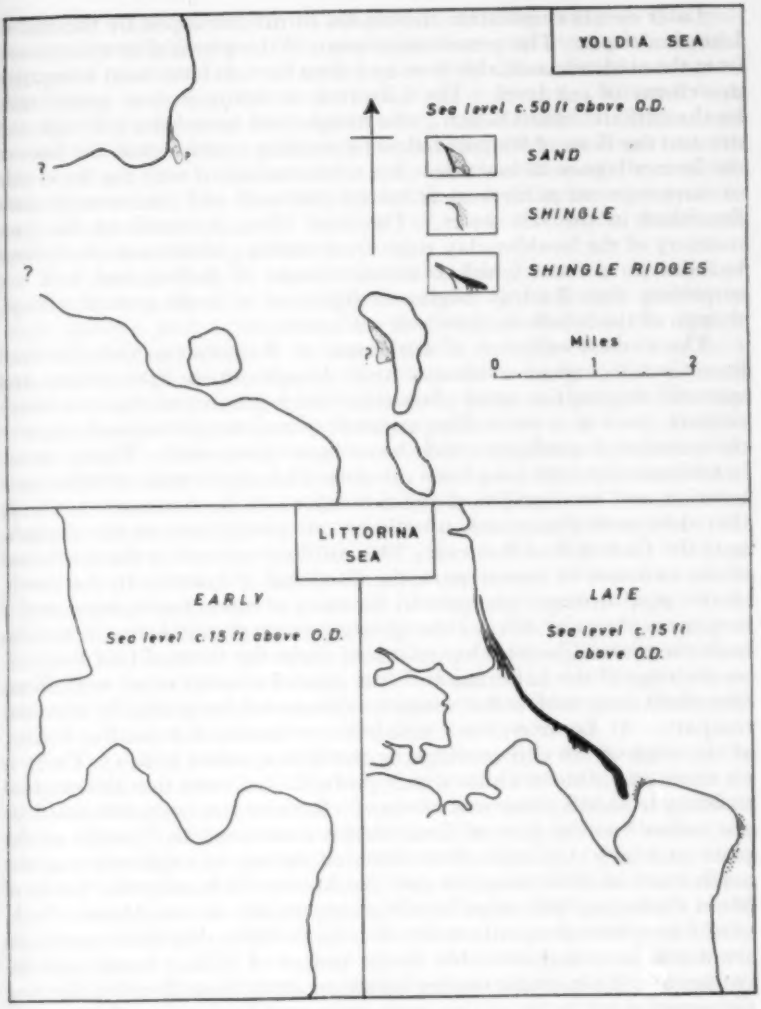


Fig. 2. Suggested evolution of the coast in the Rattray area.

have been sufficient to keep open at least one inlet, probably in the extreme south where the shingle terminates abruptly. As a result of the growth of the shingle spits the coastline now approximated to the modern one and there may have been some development of dunes. Estuarine and tidal muds accumulated behind the bar but at high tide the lagoon would have been a sheet of salt water ; at low tide it became an expanse of mud and colonising vegetation seamed by tidal channels and the main channel of the Burn of Rattray.

Later events consolidate the coastal forms developed by the end of Littorina times. The penultimate stage of the physical story appears, from the evidence available here and elsewhere, to have been a negative movement of sea level. The Littorina shoreline is now represented by the cliff and raised beach ; the shingle bars have been left high and dry and the Burn of Rattray follows a winding course across the floor of the former lagoon at low tide. Sea water rushed in with the flood-tide to carry seaweed as far west as Savoch and seals and marine organisms flourished in the salt water. The tidal inlet, sheltered by the promontory of the boulder-clay ridge from onshore winds was an obvious harbour on a coast which is almost devoid of shelter, and it is not surprising that Rattray begins to figure as a small coastal village, though of the inhabitants little is yet known.

The earliest evidence of settlement at Rattray can only be read from archaeological evidence, and though much speculation and sporadic digging has taken place since the beginning of the nineteenth century, there is as yet nothing conclusive as to the period and origin of the occasional artefacts which have been discovered. Flints, arrow heads and clay urns have been unearthed but the details of their exact location and stratigraphical position have not been recorded, except that they were discovered, usually by the ploughman or the drainer, near the Castlehill of Rattray. This artificial mound at the south end of the loch and its counterpart, the Castlehill of Lonmay in the north, clearly play an important part in the story of human settlement and if they were places of defence the question immediately arises as to who built them and against what invader. Near the farm of Old Rattray, on the edge of the Littorina cliff, the mound consists of an oval about fifty yards long with a flat summit surmounted by a slightly elevated rampart. At Lonmay, the Castlehill is a similar but smaller feature at the edge of the cliff overlooking the lowest raised beach. There is no masonry visible in either which probably indicates that the original building or fortification was of wood. Rattray has been identified by one writer [2] as the port of Trucculensis mentioned by Tacitus as the place at which Agricola's fleet wintered during its exploration of the north coast of Aberdeenshire and the Moray Firth after the battle of Mons Graupius, but other localities, especially on the Moray Firth, would have served equally well. It is more likely that these castlehills are much later and referable to the period of Viking forays and invasions and the sporadic raiding which occurred long after the Norman Conquest.

As such, the Castlehills of Rattray and Lonmay fall into the pattern of the remains of nine castles distributed along the coast between Rattray Head and Aberdour Bay on the Moray Firth coast. Seven of these castles lie on the more accessible sandy North Sea coast of Aberdeenshire and the remaining two are sited where the rocky cliff coastline of the Moray Firth temporarily gives way to lower ground. This distribution " can most easily be explained by the necessities of coast defence, an impression which is strengthened by the situations of the individual castles, except Inverallochy. Rattray commands two sandy stretches of coast and the easternmost point of the coast. . . .

Whatever date, therefore, be assigned to existing remains, it is only reasonable to believe that the sites, or the more important of them, were occupied by some form of strong post before the discontinuance of the Viking raids, say, before the end of the thirteenth century." [3] As late as 1151, Eystein, King of Norway, sailed down this coast and sacked the Royal Burgh of Aberdeen ; in 1263, the great Norse invasion came to grief at Largs and led to a reconsideration of the national defence system. The Comyn Earls in all probability strengthened the protection of the exposed ' knuckle ' of Scotland by the erection of castles at commanding points.[4]

The activities of the new land-owning families of the North East were very important in moulding the medieval landscape and settlement pattern and, apart from the Castlehill at Rattray, the earliest building still standing is a chapel which is believed to have been erected by William Comyn in the thirteenth century. The Comyns came to Scotland from England about the time of Malcolm Canmore but their original home was in Flanders at Comines. In 1214, William Comyn married Marjory, daughter and heiress of Fergus, the last of the Celtic Mormaers of Buchan and, in her right, became the Earl of Buchan. Soon after he founded the Abbey of Deer and the chapel at Rattray is supposed to have been built by him as an offshoot from the main ecclestiastical centre. Various gifts to the chapel by William Comyn are recorded including the payment of two stones of wax from the lands and mill of Strichen and Kindrought to the Chapel of the Blessed Virgin Mary in the town of Rattray.[5] The Comyn lordship of Rattray lasted until 1308 when John Comyn, Earl of Buchan, defeated by Robert Bruce near Inverurie, fled to England and suffered the confiscation of his large estates in Aberdeenshire, Banffshire and Galloway, while the land of Buchan was razed with fire and sword.

In 1324 the Lordship of Rattray, together with the harbour at the east end of the tidal inlet and the lands of Crimond, passed to Sir Andrew Douglas for services rendered to the crown, but by the middle of the fifteenth century the lands of the Barony had been broken up, passing through various hands until eventually, in 1459, they were received from James II by William Earl of Erroll. It would seem from later events that this was the part called Haddo Rattray which lay to the west of the burn which flows into the present loch to the west of St Mary's chapel. The town and lands at the east side of the burn, including the Chapel itself, eventually passed into the hands of the Keiths of Broadland. There were, thus, on the eve of the reformation, the lands of the relatives of the High Constable of Scotland and the lands of the Earl Marischal's family side by side.

In the middle of the sixteenth century, the townlands of Rattray on the silty stone-free soils of the ' fifty-foot ' raised beach were, for the most part, a commonty where the townsfolk pastured their cattle and obtained materials for building the sod walls of their houses. In places they would have enclosed small fields and gardens, while beyond the margins of the head-dyke the land was open to all the people of the township, which lay within the lands of Broadland of Rattray held by the Keiths. Andrew Hay, Master of Erroll, proprietor of Haddo of

Rattray, appears to have coveted the townlands and to have been using them along with the townsfolk and he was no doubt desirous of having control over the harbour as well. After the Reformation he represented to Queen Mary that certain legalities of possession had not been complied with by the Keiths and claimed the forfeiture of the town and townlands of Rattray to his own domains, bringing an action before the Lords of Council and Session to oust the Keiths from proprietorship. The attempt failed but, in order, presumably, to obviate any bitterness between two such important families of Scotland, the Lords proposed to Queen Mary that Rattray should be made into a Royal Burgh to which Keith consented. A charter of erection, still in the possession of the Cumines of Rattray, was drawn up in March 1563 (by modern reckoning 1564), which gave the burgesses the right to set up a market cross and to hold a weekly market and twice yearly fair. The charter also mentioned the possibility of improving the houses of the township by building with stone and lime instead of sods and gave a large piece of ground to the Burgh as a commonty which the Burgesses might let or sell as they thought fit.

There is little doubt that, at this time, the harbour of Starnakeppie at Rattray was flourishing, as the inhabitants sought the white fish off the coast and learned to negotiate successfully the treacherous navigational hazard of the submerged rock platform of Rattray Briggs. The amount of trade which was done by the harbour is nowhere mentioned, but Rattray appears to have had contact with the continent through the Dutch who fished from their busses along the east coast of Scotland. In the old *Statistical Account of Fraserburgh*, written at the end of the eighteenth century, it is mentioned that at the beginning of the previous century the Dutch used to frequent the harbour and inlet of Rattray,[6] but whether any trade resulted from this association is not known. Apart from being a place of shelter, the harbour at Rattray was probably only of local importance ; it was used by the boats of the Royal Burgh but their owners probably spent as much time in agriculture as they did in fishing. The settlement itself, of which no details, apart from the Chapel, are now visible either from the ground or the air, seems to have been strung out along the road which leads from the Castlehill to the Chapel and, notwithstanding the exhortations of the charter, it seems doubtful whether the houses were ever constructed of stone.

The Royal Burgh of Rattray, despite its grandiose title, did not prosper to the extent which had been envisaged. From various charters in the late fifteenth and early sixteenth centuries it is apparent that the burgesses had begun to sell their lands to outsiders, and the baillies witnessing the transactions also came from outside the burgh. By the time of the Aberdeenshire Poll Tax Returns in 1696, there were only seventeen adult persons, including four fishermen, above the age of sixteen in the Royal Burgh but some seafaring activities were carried out from the harbour since other townships in the vicinity such as Bilbo, Broadland and Lochbanks also had a small quota of seamen and fishermen.[7] The only proprietor of a feu in Rattray in 1696 was one John Scott and he had a tenant in his place at the farm of Lochbanks

(probably on the site of the more modern farm of Old Rattray). The causes of the decline of the burgh may be read both from the ground and from historical documents. They indicate coastal changes whereby the vulnerable throat of the harbour between the shingle bar and the old Littorina cliff became choked with sand.

As early as 1654, Sir Robert Gordon of Straloch, describing the locality of Rattray Head, mentions the small inlet of Strathbeg by then almost obliterated with sand. Near it were the remains of the town of Rattray which was following the fortunes of the once noble harbour.[8] It is probable that this was a temporary blockage which did not fill the channel completely but caused a shallowing which seriously impeded the movement of small coastal craft; difficulty would have been experienced except at high water under relatively calm conditions. The bar may even have been completely removed in time since the account by Alexander Hepburn in 1721 says: "Crimond is divided from Lonmay by the river Rattray, at the mouth of which river on the south side is situate the village of Rattray, famous for codfish which the inhabitants take in great plenty and have the best way of drying and curing them. There are many sea calves in the mouth of the river and this is the reason why there are no salmon there."[9] This clearly implies a channel of sufficient depth for boats to enter and also a fisher population, but from other evidence it seems probable that the account was written some time before it was published. Alexander Keith in his *View of the Diocese of Aberdeen* in 1732 says that Rattray once had a good harbour but at that time it was choked up with sand and the town consisted of but nine or ten houses belonging to Haddo and Broadland.[10] Finally, in the old *Statistical Account of Crimond*, it is said that "at the beginning of the present century, 1700, the lake was of much smaller extent than it is now. It was confined to a small part of the east end and had a communication with the sea there so that vessels of small burden could enter it. People born about 1700 well remember the overflowing of the west part of the loch; but the particular year is not known, though it must have been about 1720. Previous to that there was a hill of sand between the Castlehill of Rattray and the sea and still higher than it. A furious east wind blew away this sandhill in one night, which stopped the communication between the loch and the sea by forming a sand bar. The lowlying ground to the west was soon overflowed and the extent of the loch much increased."[11] Thus runs the tradition written within the lifetime of individuals who may have seen the change take place and some later evidence tends to substantiate the idea of a sudden drift of sand. Alexander Cumine of Rattray in the process of improvements noted the clear-cut division between the soil and the overlying sand, remarking that there was no sand mixed with the old, high, cultivation ridges.[12] So sudden was the final sealing of the outlet that a small vessel is reputed to have been trapped within the harbour and its cargo of slates used to roof the Mains of Haddo.

Map evidence is unfortunately lacking for substantiation of the story until Roy's map of 1747-55 of which the relevant section is reproduced (Pl. 1). It indicates the bar quite clearly, the road from

Peterhead to Fraserburgh crossing the old outlet and running along the bar, and a new channel formed at the north end of the lagoon which had now been filled in with fresh water to form the modern Loch of Strathbeg. Rattray Chapel is indicated and the unnamed township of Bilbo between it and Haddo, but there is no indication of the Royal Burgh. Plans of the Estate of Rattray, dated 1813 and 1842, show no trace of the old settlement. The effacement was complete except for the ruin of St Mary's Chapel and commemoration in the names of fields such as Shore Wynd. The Royal Burgh of Rattray must have ceased to exist before the middle of the eighteenth century after a recognised life of less than two hundred years, of which only the first hundred were relatively prosperous. Deprived of the harbour and forced to gain a living from the land alone, the population quickly declined as the economic reason for their existence by the harbour was removed. Some hardy fishermen continued to operate from the open shore, following the coast as it prograded, from Seatown and Botany (so called from its resemblance in terms of remoteness to the then recently established convict settlement in New South Wales), but they probably gained a greater livelihood from plundering the wrecks which came ashore on Rattray Head than from the fishing itself. Eventually they moved away in the 1830's when six or seven families went to the new fishing village of Burnhaven near Boddam : " they having found the landing at the former place too hazardous for carrying on their occupation with profit or success." [13]

For a time the fresh water brought into the loch seeped away through the shingle of the bar and the sand, but with the increased deposition of silt and mud and colonisation by aquatic vegetation the level of water in the loch gradually rose until it washed against the recurved laterals of the shingle spit, so that the small promontories on the east shore of the loch are formed by the lateral shingle ridges. On the west the water came to rest against the Littorina cliff and in the north it flooded the lowlying ground. Since the old outlet could only be used intermittently and good agricultural land was inundated by the waters of the loch, attempts were made to drain it during the era of improvements at the end of the eighteenth century. The feeding burns were intercepted and their water carried across the basin in a partially raised aqueduct through a cut in the shingle ridges and then north by a canal dug between the fossil cliff and the sand dunes along the seaward margin. The remains of the canal are still visible. The enterprise was abandoned on the death of the proprietor and since then an outlet has been maintained simply by keeping clear the cutting through the shingle ridges. During the First World War the level of the loch was artificially raised to serve the seaplane station established at the south end, leading to further inundation of fields and encouraging the growth of marsh vegetation which now clothes the shores.

On the seaward side of the bar, combined wind and wave action have caused considerable accretion. At the time of the *New Statistical Account* it was remarked that " it is a matter of observation to old persons, as well as of tradition, that the sea has receded considerably," [14] and a comparison of the various editions of the six-inch map and air

photographs demonstrates that the process still continues. The sandy foreshore is backed by a main dune ridge, partly fixed by marram, with blow-outs aligned in a north-south direction. Embryonic fore-dunes rest against the seaward flanks of the main ridge and both show evidence of erosion by storm waves. Inland, towards the shingle of the bar, three main grey dune ridges are visible, separated from each other by depressions running parallel to the coastline. The grass-covered shingle ridges themselves are occasionally surmounted by low dunes supporting heath vegetation. The whole dune complex appears to be aligned in relation to a dominant wave approach from the north-east but the development of the series of ridges appears also to owe something to forces from the south-east.

In common with other localities on the coast of North East Scotland there is a tendency, at present under investigation, for a movement of material in a northerly direction. This is indicated by the deflection of the stream outlets of the coastal-slope drainage. At some earlier stage in the evolution of the coast the rivers appear to have been deflected south. At Rattray the two directions of movement are shown in close juxtaposition. The shingle bar of Littorina times grew in a southerly direction but half a mile to seaward a modern sand bar is prograding in a northerly direction leaving a long inlet between itself and the dune ridge of the mainland proper. The sand bar has been colonised by marram and dunes and the margins of the tidal inlet are rapidly being colonised by halophytes. The seaward extension of the coast here may, therefore, have taken place by the development of a sand bar behind which a tidal inlet became colonised by vegetation and across which sand from the seaward dune ridge was blown. In this case the longitudinal hollows between the dune ridges may represent the last vestiges of old inlets.

The evolution of the coastline in the vicinity of Rattray Head illustrates quite clearly the dynamic effect of wind and waves on a low sandy coast. The erasure of the bay of late-glacial times as a result of changes in the level of land and sea, coupled with deposition and spit and sand dune development, has produced one of the sweeping, sandy bays of which this section of the coastline of North East Scotland is formed. The Royal Burgh of Rattray disappeared in historic times, not by coastal erosion, nor by a Pompeii-like internment beneath drifting sand, but because the harbour mouth was blocked by sand swept in from the beaches by waves and wind. The economic reason for its existence was removed by the loss of the harbour, the fishermen moved away and the plough of the farmer and crofter obliterated the site of the burgh so successfully that its location would have been lost but for the survival of charters and the ivy-covered ruin of the old chapel. The growth and decay of the harbour of Rattray, linked so closely with these concomitant physical changes, illustrates the rapidity with which such transformations of coastal environments take place and the helplessness of the inhabitants during a period of low technical achievement.

[1] JAMIESON, T. F., On the history of the Last Geological Changes in Scotland. *Quart. Journ. Geol. Soc.*, Vol. XVI, 1865, p. 161.

[2] MILNE, J., Rattray. *Trans. Buchan Field Club*, Vol. V, 1898-1900, pp. 180 ff.

[3] SIMPSON, W. D., quoting Lord Saltoun—Cairnbulg Castle, Aberdeenshire. *Proc. Soc. Antiquaries Scot.*, Vol. LXXXIII (Vol. XI, Seventh Series) Session 1948-1949, pp. 34-35.

[4] SIMPSON, W. D., *The Earldom of Mar*, Aberdeen, 1949, pp. 8-9.

[5] MILNE, J., *op. cit.* There is a great deal of information on the historical aspect of Rattray in this article.

[6] *The Statistical Account*, Vol. VII, Fraserburgh, p. 3. Edinburgh, 1793.

[7] *List of Pollable Persons within the Shire of Aberdeen 1696*. 2 vols. Aberdeen, 1844.

[8] GORDON, R., Description of the Sheriffdoms of Aberdeen and Banff. *Collections for a History of the Shires of Aberdeen and Banff*. Aberdeen, 1843, p. 19.

[9] HEPBURN, A., Description of Country of Buchan. *Macfarlane's Geographical Collections*, Vol. I. Scottish History Society, Edinburgh, 1906, p. 40.

[10] KEITH, A., View of the Diocese of Aberdeen. *Collections for a History of the Shires of Aberdeen and Banff*. Aberdeen, 1843, p. 425.

[11] *The New Statistical Account*, Vol. XII, Crimond, p. 709. Edinburgh, 1845.

[12] CUMINE, A., The Burgh of Rattray. *Trans. Buchan Field Club*, Vol. I, 1887-1890, p. 119.

[13] *Op. cit.*, Vol. II, p. 709.

[14] *New Statistical Account*, Vol. XII, Lonmay, p. 219.

GEOGRAPHY APPOINTMENTS IN SCOTTISH UNIVERSITIES, 1956

ST ANDREWS: Miss Kathleen MacIver, M.A., PH.D., has been appointed Head of Department. Formerly in the Colonial Service, Uganda, and later Assistant in Edinburgh University, she was first appointed Lecturer in St Andrews in 1953.

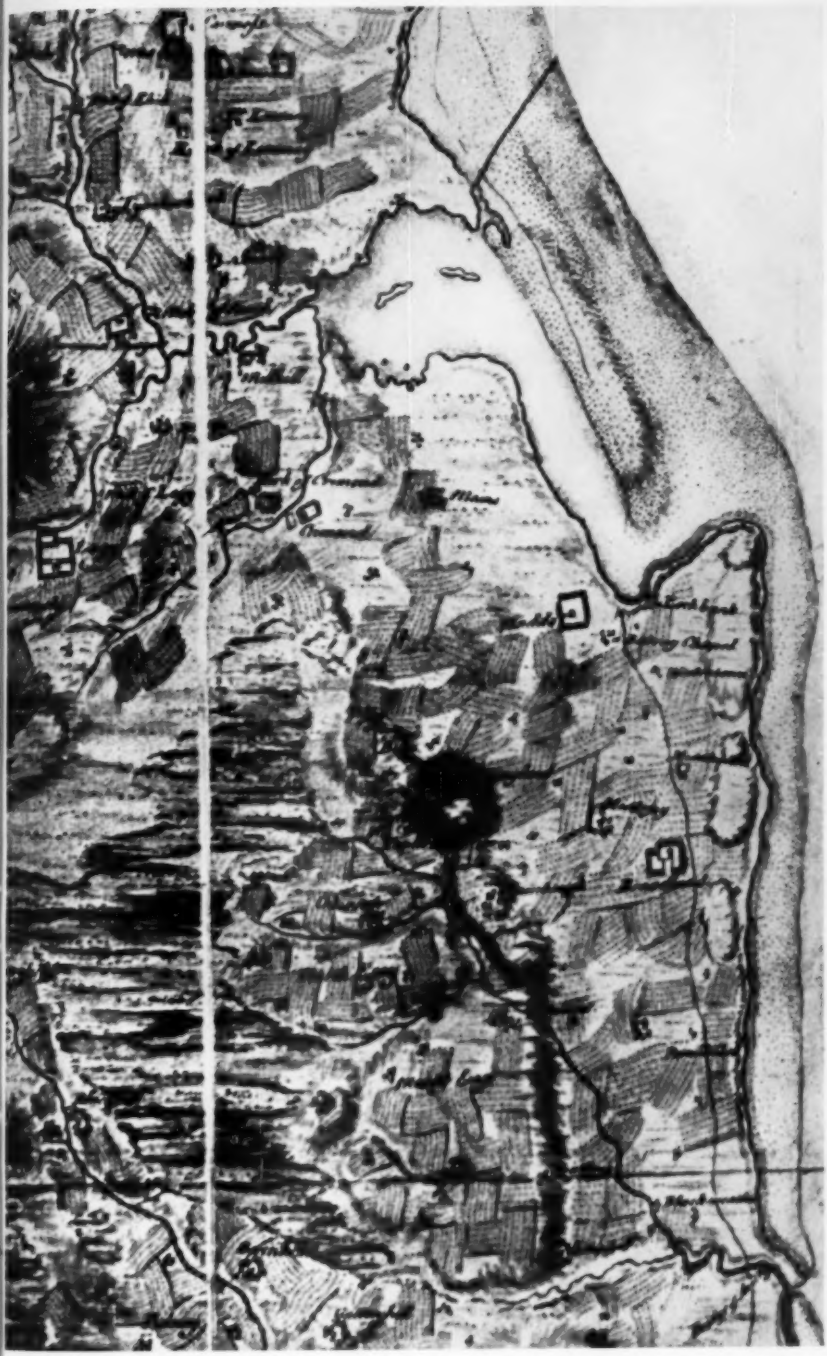
Lecturer: Mr H. Paterson, M.A., formerly demonstrator in Geography, Cambridge University.

GLASGOW:

Lecturer: Miss Joy Tivy, B.A., B.SC., PH.D., formerly Lecturer, Edinburgh University.

EDINBURGH: The resignation of Miss Catherine P. Snodgrass, M.A., PH.D., Assistant 1936 and Lecturer since 1945 has been announced.

Lecturers: Mr N. R. Elliot, B.A., PH.D., formerly Assistant, Edinburgh University.
Mr A. P. MacPherson, M.A., formerly Lecturer, Aberdeen University.
Mr R. O. Osborne, B.SC., PH.D., formerly Assistant, Edinburgh University.



Pl. 1 (See p. 93). THE LOCH OF STRATHBEG

The coast of Aberdeenshire to the north and south of Rattray Head according to Roy (1747-55): Reproduced at the original scale.

Pl. 2 (See p. 97). THE CARLUKE MEMORIAL TO MAJOR-GENERAL WILLIAM ROY, FOUNDER OF THE ORDNANCE SURVEY

By a happy thought the memorial plaque is embodied in O.S. BM S 8761 in the survey pillar which stands on the site of Roy's birthplace. It was unveiled by Major-General Willis, Director-General of the Ordnance Survey who is shown using the theodolite which held down the Union flag veiling the memorial. With him are Colonel Edge and Major Simson, also of the Ordnance Survey.

MAJOR-GENERAL WILLIAM ROY, F.R.S.

RONALD MILLER

"ACCURATE surveys of a country are universally admitted to be works of great public utility, as affording the surest foundation for almost every kind of internal improvement in time of peace, and the best means of forming judicious plans of defence against the invasions of an enemy in time of war". So spoke Major-General William Roy, F.R.S., before the Royal Society in London in 1785. On the 4th of May 1956, the 230th anniversary of his birth, Major-General Willis, Director-General of the Ordnance Survey unveiled at Miltonhead, Carluke, a plaque to commemorate the birthplace of this distinguished Scottish soldier, archaeologist and map-maker who was responsible for the first beginnings of our national surveys. By a particularly happy thought, the Roy memorial (Pl. 2) is embodied in O.S. Bench Mark S 8761 in the survey pillar which has been erected on the site of the house of Miltonhead.

Roy was of good Scottish origin. His father and grandfather had been factors to the lairds of Milton. Lockhart of Lee witnessed his baptism, and he was schooled at Carluke and Lanark Grammar. His younger brother, James, matriculated at Glasgow University in 1742 and became a minister, but William no doubt assisted his father, probably as draughtsman and cartographer in his duties of land management. It is possible that he also worked in the post office in Edinburgh.

He grew up in troubled times: parts of Scotland refused to recognise the Hanoverian monarchy and events culminated in the rebellion of 1745, and the defeat at Culloden by the 25-year-old Hanoverian Duke of Cumberland of the 26-year-old Stewart, Prince Charles Edward. On Cumberland's staff was Lt-Colonel Watson, also a Scotsman and Deputy Quartermaster-General, whose plan for the Highlands was to continue Marshall Wade's policy of road building, coupled with a programme of detailed and accurate mapping. It was into his staff that young William Roy went in his twentieth year, setting his feet on a ladder that was to take him to the top of his profession. Based on Fort Augustus, he became the principal agent in the production of the first large-scale map of Scotland, and for that matter, of any part of Britain. On a scale of one thousand yards to the inch (nearly 2 inches to 1 mile) it shows not only natural features but individual dwelling houses and—significant of Roy's interests—antiquarian sites, especially Roman. The main instrument was the compass and distances were estimated rather than accurately measured. Roy himself says of it:—"Although this work, which is still in manuscript, and in an unfinished state, possesses considerable merit, and perfectly answered the purpose for which it was originally intended; yet, having been carried on with instruments of the common, or even

inferior kind, and the sum annually allowed for it being inadequate to the execution of so great a design in the best manner, it is rather to be considered as a magnificent military sketch, than a very accurate map of a country." (See Pl. 1.)

It was never printed, and the thirty-eight manuscript sections now lie in the British Museum. Photostat copies are held in Scotland at the Universities of Glasgow, Aberdeen and Edinburgh.

The war of 1755 brought work to an end and Roy, who had probably already been commissioned in the 4th King's Own Foot, received by Royal Warrant appointment as one of eight Practitioners in the Royal Engineers, the first increase of establishment to the Corps since its founding in 1717. In the following year, an invasion scare transferred Roy to the south coast for survey work and he was employed there and in other theatres of war, at home and abroad, for the next twenty-eight years. We need not follow his career in detail except to note his success. He became Major in 1761, Lt-Colonel in 1762, Colonel in 1777 and Major-General in 1781. Two years later he crowned his military career by becoming Director and Lt-Colonel of Engineers and in 1786 Colonel of the 30th Regiment of Foot.

During such leisure as this career afforded him, Roy had been pursuing the scientific study of some aspects of his profession. We find him giving a lengthy paper to the Royal Society—of which he had become a Fellow—on the measurement of heights by means of the barometer. This reveals that he had been sighting angles and experimenting with barometers in the Highlands, on Arthur's Seat and on Snowdon. His great interest in Roman antiquities, however, was not fully revealed until after his death when, in 1793, the Society of Antiquaries published his *Military Antiquities of the Romans in North Britain* in 205 sumptuous folio pages with fifty-one maps and plates. He examined Roman military practices, particularly of encamping, to throw light on the form of Roman sites in Scotland. The great camp at Carstairs, near his home, is one of his interests and he shows a detailed knowledge of the Roman roads in his home country. He maps the Antonine Wall across the waist of Scotland at a scale of 1 inch to 1 mile thus recording it for posterity before the agricultural and industrial revolutions all but obliterated it. The work remains a classic of British archaeology, particularly as to its maps and plates.

To success in two careers—soldier and archaeologist—Roy was yet, however, to add another, that of founding the scientific mapping of this country on a national scale.

Throughout his long military service, he never lost sight of the necessity for a national survey. His hopes rose on the conclusion of peace in 1763, but the American War supervened before anything could be done. Roy, however, had not been idle. "In the course of my ordinary military employments, wherein the very best opportunities have offered of acquiring a thorough knowledge of the country" he went ahead with his private plans, noting where bases and trigonometrical points could be established. After the peace of 1783 he was actually amusing himself by measuring a base of 7744·3 feet across the fields between the Jew's Harp, near Marybone (*sic*) and Black Lane

near Pancras from which he proposed to observe a series of triangles linking the principal steeples of the city to the Royal Observatory.

In 1784, however, the French Astronomer, Cassini, proposed that Britain and France should co-operate to measure precisely the relative positions of the observatories of Paris and Greenwich. The Royal Society of London petitioned King George III to finance the necessary geodetic survey and "A generous and beneficent MONARCH, whose knowledge and love of the sciences are sufficiently evinced by the protection which HE constantly affords them, and under whose auspices they are seen daily to flourish, soon supplied the funds that were judged necessary." Through the influence of the President, Sir Joseph Banks, Roy was commissioned to undertake the task.

The first stage was to measure a base to an accuracy hitherto never attempted. Roy chose a line on Hounslow Heath, running from the Magpie at King's Arbour near Heath Row to the Poor House half a mile west of Bushey Park. The ends were marked by wooden posts set in old cart wheels sunk six feet into the ground. "Chiefly with a view to the more effectual execution of the work, it was judged to be a right measure to obtain and employ soldiers, instead of country labourers, in tracing the base, clearing the ground (of furze-bushes and ant-hills) and assisting in the subsequent operations". Roy considered not only that "this was obviously the most frugal method" but also "that soldiers would be more attentive to orders than country labourers". From the outset, then, the army, in the persons of General Roy, one Sergeant, one Corporal and ten men of the 12th Regiment of Foot, are connected with our national survey. The Director-General and principal officers of the modern Ordnance Survey are still Royal Engineers though the organisation is a civilian one coming, curiously, under the Ministry of Agriculture and Fisheries.

The measuring of the base took nearly three months, for the utmost accuracy was used and the best method had to be found by experiment. At first, deal rods, cut from a Riga mast given by the Admiralty were used. These twenty-foot rulers proved to vary as much as one-thirtieth of an inch per day as a result of humidity changes and were discarded. Glass tubes, whose coefficient of expansion with temperature had been determined, were then used and checks showed that they were satisfactory. A steel chain had also been made for the occasion but was used only for checking. Roy had great confidence in the work and, after reduction to sea level, announced the length of the base as 27,404·7219 feet, but as he was not quite sure what sea level was "we will throw away some useless decimals and establish the ultimate length of the base at 27,404 feet and seven-tenths."

The whole project excited great popular interest. The President of the Royal Society "not only gave his attendance from morning to night in the field, during the whole progress of the work; but also, with that liberality of mind which distinguishes all his actions, ordered his tents to be continually pitched near at hand, where his immediate guests and the numerous visitors whom curiosity drew to the spot, met with the most hospitable supply of every necessary and even elegant refreshment". The King, too, "deigned to honour the operation by

HIS presence, for the space of two hours, entering very minutely into the mode of conducting it, which met with HIS gracious approval". A subsequent re-measurement of the base by steel chains in 1791 differed by only two and three-quarter inches.

To measure the angles necessary for the triangulation, Ramsden, the foremost instrument maker of the day was directed to make the greatest of all theodolites, with a horizontal circle of three feet in diameter with telescopes of thirty-six inches focal length. Ramsden, to Roy's disgust, took three years to complete this instrument. Punctuality, however, was not his forte. On one occasion, it is said, it was announced to his patron, the King, that Ramsden was in attendance outside by appointment. He was admitted and showed his order for appointment, on which the King commented "You are precise, Mr Ramsden, with regard to the hour and the day of the month, but you are a year behind the time I appointed".

In 1787, however, the cross-Channel link was effected and a check base of over five miles in Romney marsh was measured with a steel chain. An error of less than one part in 12,000 was revealed, an accuracy beyond anything ever before attained.

Roy's efforts were acknowledged by the award of the Copley Medal of the Royal Society in 1785 and he continued to extend his triangulation. With his sudden death in 1790, however, the work came to a standstill and was not resumed until a year later, when, continuing the military tradition, the direction of the work was entrusted to the Master-General of the Ordnance and the execution to the Royal Engineers. Their work has since become a national institution and Britain enjoys a map service of unsurpassed accuracy and amplitude. The truncated pyramidal pillars which the latest revision has placed on so many of our hill tops may serve to remind us of that one at Carluke and of William Roy of Miltonhead.

This article is an amplified version of one on the same subject by Professor Miller published in the *Glasgow Herald* on the 4th of May 1956 on the occasion of the anniversary.

NEWBIGIN PRIZE

A Bronze Medal and Money Prize will be awarded for the best Essay, suitable for publication in *The Scottish Geographical Magazine* and not exceeding 7,000 words in length, on any subject relating to the geography of Scotland.

Essays typed and with any illustrations prepared for reproduction, in envelopes marked 'Newbigin Prize,' must be lodged with the Secretary, Royal Scottish Geographical Society, Synod Hall, Edinburgh 1, on or before 31st October 1956.

TEESDALE: A TRANSECT SURVEY AT SCHOOL LEVEL

G. T. L. Chapman and J. E. Waltham

> " One traverse in a Surrey Vale
> (Or if you prefer it, Yorkshire dale)
> Will teach you more of Man,
> Of Man in his terrestrial home,
> Than all the text-books can ! " [1]

This parody by Professor S. W. Wooldridge on some of Wordsworth's lines aptly expresses a truth which few geographers would deny. Field work is the very essence of their subject and is essential to stimulate the interest of young students. At the Queen Elizabeth Grammar School, Darlington, geographical field work in the VIth Form is in fact encouraged by the nature of the syllabus (University of Durham School Examinations Board) for the Advanced Level of the General Certificate of Education. The examination at this level includes, as well as two three-hour papers, a three-hour practical (oral) on map interpretation, etc ; some marks are also reserved for an individual piece of survey work which has to be done by the pupils in their own time.

In this school, of 750 boys and a ' four-stream ' entry, practically every boy takes geography up to the end of his fifth year, at which time he normally enters for the G.C.E. examination at the Ordinary Level. The demands of the school curriculum however allow little field work up to this stage. Boys who continue their studies into the VIth Form usually divide their time thereafter between three subjects. Those taking geography at this later stage usually come from the ' science stream ' and choose their two other subjects from biology, geology, mathematics and art ; those from the ' arts stream ' make their choice from history, economics and French.

In the Lower VIth Form, six 45-minute periods a week are devoted to geography, three of these being grouped together to form one afternoon practical class. This is increased to seven periods (still including the afternoon practical class) in the Upper VIth Form. At the end of this year the pupils take the G.C.E. examination at the Advanced Level and then many leave, including some going to Universities. Some, however, doing exceptionally well in this examination spend yet another year, in the Scholarship VIth Form, where they may reduce their subjects to two ; they have four special periods and, in addition, most of them attend the Upper VIth Form classes.

Field work then, in the true sense, is confined to these three VIth Form years, where it falls into three categories :

1. Occasional local excursions during the ' practical afternoons '.
2. An annual voluntary excursion of ten days during the Summer vacation to such areas as the Cairngorms and the Isle of Arran.
3. An annual ' field trip ' of three to four days at the end of the Easter term, when it does not involve the loss of much teaching time in other subjects.

The problem is, however, to find an efficient method of pursuing field studies when, as in the latter instance, only a few days of the annual school curriculum can be allotted for this purpose. It is vital to use what time is available to the best advantage and to adopt a method which gives the pupils the maximum opportunity to collect observable data for themselves. The transect, a well-known and established method, is a good solution to this problem. Its value is that it concentrates the activities of a group of pupils on a small area, allows specialisation and gives each pupil the opportunity of acquiring some knowledge of field techniques. It can be presented to the student as a piece of research and has the advantage from the teacher's view point that previous detailed knowledge of the area is not essential. Furthermore, a geographer using this method, while aiming at a regional synthesis, can employ and co-operate with specialist teachers in biology, geology, chemistry and other related subjects and so help the pupils to see more clearly the interdependence of one subject upon another.

In April 1954 the annual field trip (category 3) took the form of a survey transect across Upper Teesdale (Fig. 1) and was run in conjunction with the Geology Department. Twenty-four of the twenty-six boys who participated were doing geography at the Advanced level and, coming from the 'science stream', most of them were also studying biology and geology: a mixture of Lower, Upper and Scholarship VIth Forms their ages ranged from 16 to 18 years.

Careful thought was given to the choice of the line along which the transect was to be carried out and the 1:25,000 Ordnance Survey maps provided a good indication of the various possibilities. Finally a line, five miles long, running from Fendrith Hill (2,284′) on the north side of Teesdale, to a trigonometrical point (2,085′) on the south side, crossing the River Tees at a convenient footbridge was chosen. It had the merit of passing quite close to the Youth Hostel,[2] at which the party stayed. This line provided a cross section of the valley which offered much variety in geology and altitude. A preliminary reconnaissance by two members of the staff, who later led the party, confirmed these points and ensured that there was free access through farms and across the moors.

The Upper Tees is cut into the Lower Carboniferous Yoredale Series (see Fig. 2), here consisting of alternating and almost horizontal beds of limestone, shale and sandstone resting with strong unconformity on a platform of highly contorted Lower Palaeozoic slates; the latter are exposed at a few places in the area. This alternation of resistant and non-resistant bands of rock is reflected in the characteristic 'stepped appearance' of the valley sides. The most remarkable feature of the valley is, however, the dark edge of Cronkley Scar which results from an intrusion of igneous rock in the form of the Whin Sill. From Fendrith Hill, the highest point of the transect, with its capping of Millstone Grit, an extensive view of the whole valley and of the flat-topped peneplaned surface of the North Pennines can be obtained. On the floor of the valley, the evidence of the Teesdale Glacier is well displayed in fine sections of boulder clay, drumlins and *roche moutonnées*. With a range in height of only 1,100 feet between the bottom of the valley and the

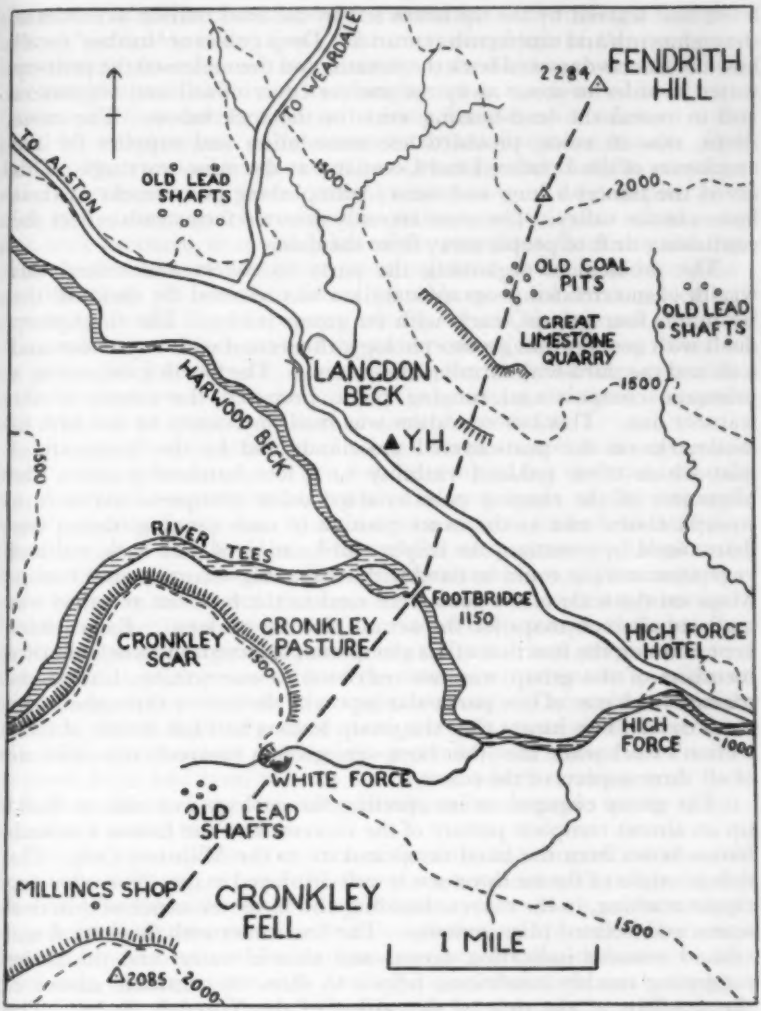


Fig. 1. Map showing line of transect survey (dashed line) across Teesdale. Based on Ordnance Survey Map, with the sanction of the Controller of H.M. Stationery Office.

highest point of the transect, the constant and rapid variation of rock type, degree of slope and drainage result in many easily recognisable changes in soils, vegetation and land use within a relatively compact and restricted area.

The present day economy of the dale revolves almost entirely around hill sheep farming with the rearing of store cattle, but evidence of former occupations is also visible. The hillsides are riddled with old

levels and scarred by the tip heaps left by the lead mining activities of the eighteenth and nineteenth centuries. Deep gullies or 'hushes' recall how the miners dammed back the streams and then released the pent-up water in order to scour away the surface cover of soil and vegetation and to reveal the lead-bearing veins in the rock below. The mine shops, now in ruins, provided accommodation and supplies for the employees of the London Lead Company at the mine workings. This saved the miners a long and weary tramp along pony tracks to their houses in the valley. The more recently deserted farmsteads reflect the continuing drift of people away from the dale.

The problem of organising the party to collect and record this wealth of interrelated geographical data was resolved by dividing the boys into four groups, each with its group leader. The first group dealt with geology and geomorphology, the second with vegetation and soils and the third with farming and mining. The fourth group using a prismatic compass and ranging poles, prepared the course of the transect line. This last operation was made necessary by the lack of landmarks on the peat-covered moorlands and by the frequency of mist which often reduced visibility to a few hundred yards. The alignment of the ranging poles enabled other groups to maintain a straight course and as the exact position of each ranging station was determined by resection, the height and location of each rock, soil and vegetation sample could be fixed with reasonable accuracy on the map. Maps on the scale of 1:25,000 were used in the field but recourse was made to six-inch maps for the actual plotting of detail. Each leader kept notes on the function of his group and, although the work of other members of the group was not restricted to one section, leaders remained in charge of one particular aspect of the survey throughout the three days. This meant that the group leaders had full details of their section's work while the other boys were given a comprehensive picture of all three aspects of the survey.

The group engaged on interpreting the geology was able to build up an almost complete picture of the succession of the Lower Carboniferous Series from the basal conglomerate to the Millstone Grit. The deltaic origin of the sandstones was well-displayed in specimens showing ripple marking, in the current bedding and in the existence of thin coal seams and isolated plant remains. The limestones with fossil coral and crinoid remains indicating deeper and clearer water, and the shales suggesting muddy conditions, helped to show the unstable nature of the sea-floor at the time of deposition of the Yoredale Series. The tough, dark grey dolerite of the Whin Sill is well-exposed in the bed of the Tees at the footbridge. Here it is at a height of 1,150 feet but it is again encountered one mile to the south-west, at White Force, where the crags of the massive escarpment of Cronkley Scar are clearly composed of this same dark, columnar-jointed rock. The base of the Whin Sill is visible at the back of the fall resting on baked shales, here at a height of 1,500 feet, and it is quite obvious that an enormous displacement of the sill has occurred between the bridge and the waterfall. Rock specimens chosen from the chilled margins of the flow were found to be much more finely grained than those obtained from near the

centre and this difference of texture demonstrated the cooling conditions in such an igneous intrusion. The metamorphism of the limestone immediately above the sill to a crumbly sugar-like form was an indication that this rock could not have originated as a sub-aerial lava flow. Caves and clints, spring lines and karstic features on a subdued scale could be seen in many of the more important limestone bands. Old dumps of barytes and fragments of lead ore suggested that the principal mineral veins were associated with the limestones. Old coal pits, lime kilns and ganister quarries were also related to geological strata. At each rock exposure, note was taken of the character, thickness and dip of the beds and rock specimens were collected and labelled for later identification. It was thus found possible to build up a geological section across the line of transect (see Fig. 2). This does not claim to be complete in every detail and the rather complicated displacement of the Whin Sill is shown simply as a fault. But the most important fact is that it was born of the boys' personal experience, and there is no part of it which is at variance with their own observations.

The group responsible for collecting data on the soils and vegetation investigated these at 300 to 400 feet intervals along the transect and noted marked intervening changes. Use was made of any exposed profile, such as that produced by a stream cutting its bed, to facilitate the drawing of soil profiles. Soil samples were generally taken at a depth of six inches using a soil auger when necessary. These samples were sealed in numbered glass specimen tubes for later examination. Details observed and recorded at the site of each sample included the geology, type of deposition (glacial, alluvial, etc.), topography (degree and direction of slope), nature of the drainage ; whenever possible a profile was drawn to show the main horizons. The soils examined included various types of podzols, acid peat soils, meadow and riverside soils with glei horizons. All were generally acid except where the enclosed fields had been recently limed and where rendzina soils had formed on some of the limestone bands, as for example on the Great Limestone above the quarry.

Sample plant species from each of the dominant vegetation associations were collected around the site of each soil sample and put into labelled envelopes for later identification. The plant communities ranged from the improved permanent pasture of the valley bottom, through bracken-infested Fescue grassland and Nardus-dominated acid grasslands, to blanket bog with Arctic Alpine associations on the higher part of the transect. These, reflecting the predominantly acid nature of the soils, could be related to differences of natural and artificial drainage and of utilisation by man.

Finally, the group studying farming and mining dealt with conditions in a belt of country following the same direction as the transect, noting the form of the buildings and the general economy of the farms. Field sketches were made of the buildings with comments on the stone used. Some of the problems which emerged, from this study, included the relation between type, density and seasonal movement of farm stock on the one hand and the vegetation and altitude on the other, differences in the past and present area of enclosed pasture, the siting of farms in

relation to springs and to the former practice of part-time farming with mining, and the evidence of local climatic influences.

On returning to school, each soil sample was examined to obtain its colour and texture. This latter property can be quickly determined with a little practice using the New Jersey System as explained by Brade-Birks in his book *Good Soil*.[3] The acidity of the soil was estimated by using a pH meter.[4] The degree of leaching which is related to the acidity was also tested by determining the carbonate content and the base deficiency of each soil sample. The carbonate content was obtained by adding a few drops of 20 per cent Hydrochloric acid to a few grams of the soil in a watch glass. The amount of effervescence gives a relative idea of the quantity of free carbonate present. If a saturated solution of Ammonium Thiocyanate in absolute alcohol is added to a sample of dry soil, the development of a red colour is a guide to the concentration of ferric ions whose presence indicates a degree of base deficiency. Waterlogged soils, deprived of air and characterised by reducing conditions will however not show a red colour with base deficiency as the iron is in the ferrous state. If, however, a few drops of Hydrogen Peroxide are added after the thiocyanate, the red colour will appear. This test worked very well with a sample from the waterlogged greyish blue B-horizon in a soil on Cronkley Pasture. The water content was obtained by drying a known weight of the soil in a steam oven and calculating the percentage loss in weight. This did not yield very useful results as heavy showers during the three days caused variations of the water content.[5]

The significance and value of these simple tests lie, not so much in the results—the details of which may appear somewhat refined in view of the nature of this survey—but in the practical application of one subject to another in the classroom and in the basis they provide for the further elucidation and illustration of soil forming factors.

Finally the careful grid references of all the rock exposures, vegetation and soil samples which had been noted in the field enabled the relevant and interrelated information to be summarised in a tabulated form on a ' transect chart ' above a geological section. A great deal of ' human ' material could not, for reasons of space, be included on the chart and much of this was more suitably incorporated in the written accounts eventually produced by each pupil. A generalised version of the transect chart so constructed accompanies this article (Fig. 2). It illustrates the value of obtaining and recording information in such a way that the varied ecology of the valley can be readily summarised and compared. Although this method does tend to focus attention on one part of the valley, and in particular on certain sites, many of the geographical facts and principles which emerge *can* be applied to the whole of Upper Teesdale. In addition the pupils, enaged in what was to them a piece of ' original research ' could see the varied lines of inquiry being built up into a geographical explanation and synthesis of a given region.

[1] Wooldridge, Professor S. W. The Status of Geography and the Role of Field Work. *Geography*, 1955, XL (2) : 73.

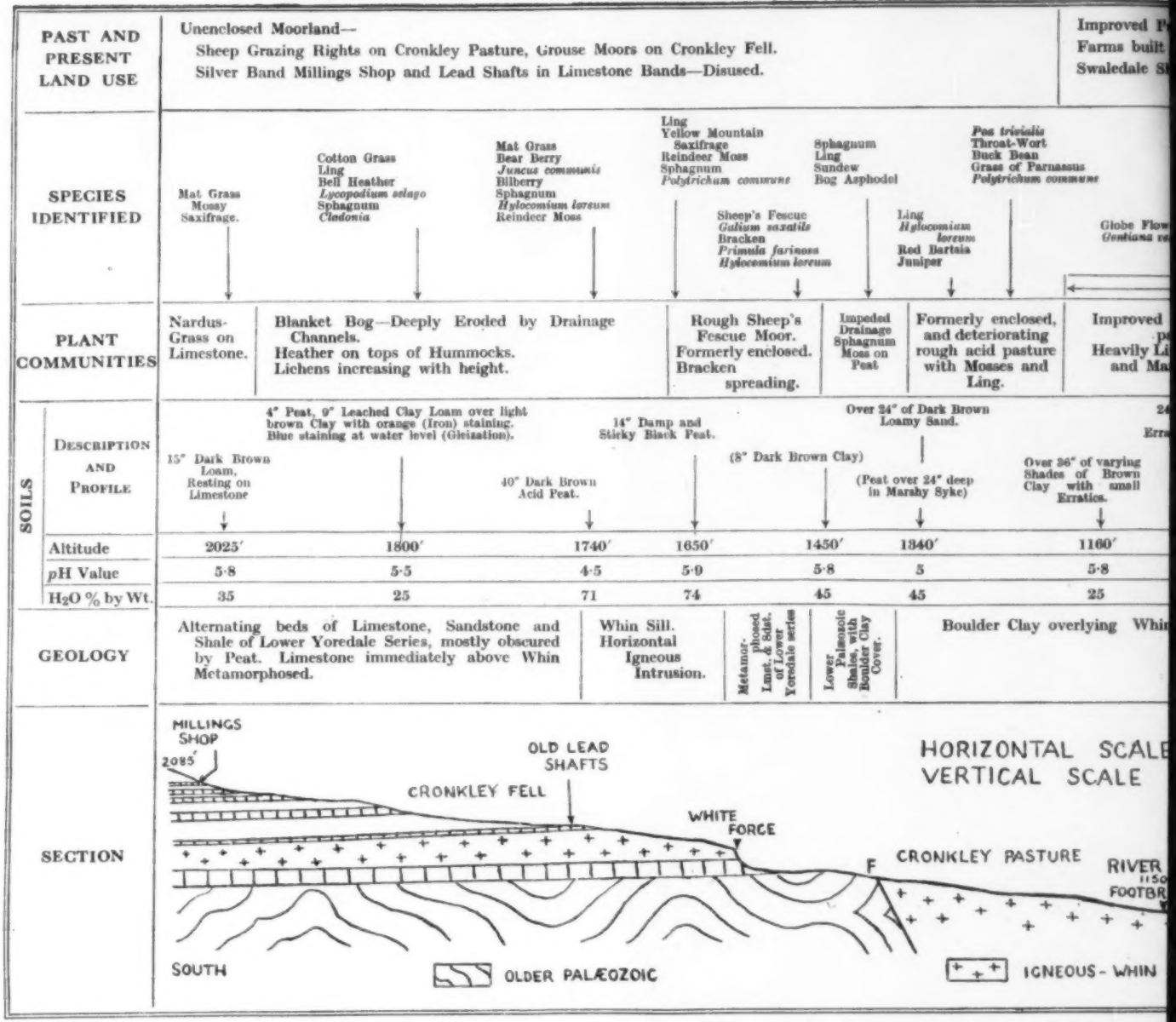


Fig. 2. Transect Chart of a North-South (appro

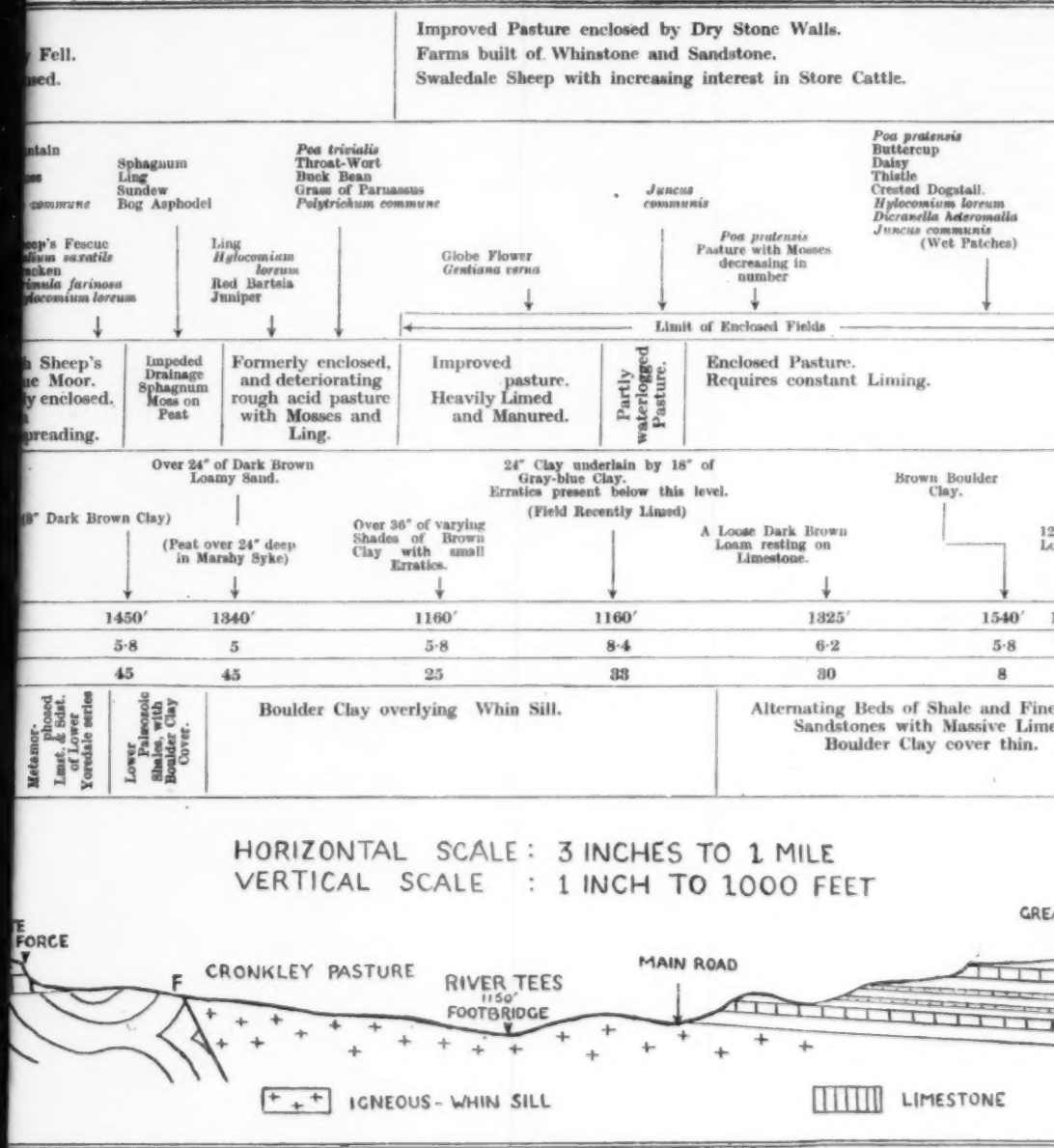
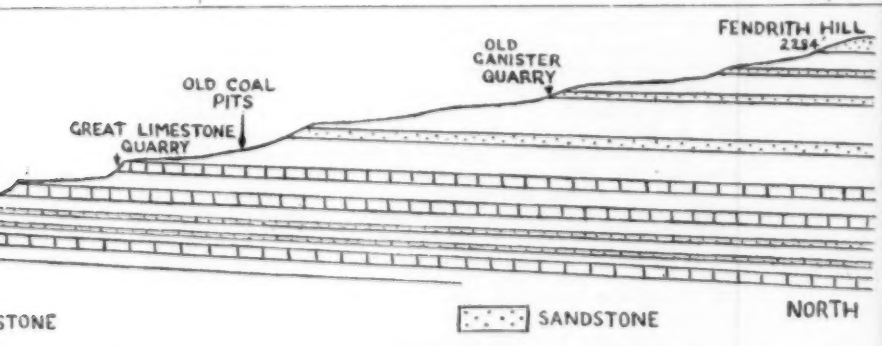


Fig. 2. Transect Chart of a North-South (approx.) Section across Upper Teesdale. April 1954.

Unenclosed Moorland. Valley Farms have Sheep Grazing Rights. Evidence of former working of Lead and Barytes veins in the Great Limestone, and of Shallow Bell Pits in thin Coal Seams. Quarrying of Ganister in Massive Sandstones.

	Sheep's Fescue Field Woodrush *Hylocomium loreum* *Mnium cuspidatum* *Arenaria verna*	Mat Grass *Juncus communis* *Galium saxatile* *Polytricum communis* *Hylocomium loreum*	Wavy Hair Grass Cotton Grass Ling Crowberry Sphagnum *Aplozia pumila*	Ling Crowberry Cotton Grass Bearberry Sphagnum *Polytrichum juniperinum* *Galium saxatile* Reindeer Moss *Cladonia pyxidata*
	Sheep's Fescue Grassland.	Nardus-Grass Moor.	Peat Moor. Streams under Peat. Drainage Channels being cut. Tree Stumps in Peat—2075′	Blanket Bog Moor.
	10″ Loose Loamy Sand on 24″ Clay Loam and Black Shale overlying Limestone.	24″ Sandy Loam overlying Sandstone.	32″ Peat resting upon 16″ Silt Loam overlying Sandstone.	64″ Peat overlying Millstone Grit.
	12″ Dark Brown Loam resting on Limestone.			
1540′	1625′	1662′	1800′	2150′	2284′
5·8	6·3	4·8	5·25	4·5	4·1
8	19	24	37	73	73
Alternating Beds of Shale and Fine Laminated Sandstones, with more Massive Beds of Quartzite Sandstones. Gentle Dip to North.					Millstone Grit.



[2] The party stayed at Langdon Beck Youth Hostel. This form of accommodation kept the costs of the expedition within a reasonable limit.

[3] BRADE-BIRKS, GRAHAM S. *Good Soil*. London, 1944.

[4] Instructions for the construction of such an instrument can be found in *The School Science Review*, June 1951 : J. T. STOCK, ' The Experimental Construction of Neutralisation Curves.' It is however quite expensive to make and fairly satisfactory results can be obtained using the colour indicator method. Messrs The British Drug Houses Ltd supply a compact case containing indicator solutions with a card of standard colours for comparison. This apparatus has the advantage of being easily carried for use in the field.

[5] MCLEAN, R. C. and COOK, W. R. IVIMEY. *Practical Field Ecology*. London, 1946.

THE INTERNATIONAL UNION FOR THE CONSERVATION OF NATURE

The International Union for the Protection of Nature, as it was known until recently, was founded in 1948 with the help of U.N.E.S.C.O. and has a Secretariat in Brussels. With the Nature Conservancy and the Society for the Promotion of Nature Reserves as joint hosts, the Union held its Fifth General Assembly and Sixth Technical Meeting in Edinburgh from the 20th to the 28th of June 1956. Some 300 representatives of wild life, natural history, and conservation organisations in forty countries attended, the majority being from the United Kingdom, Netherlands, France, U.S.A. and Germany (West and East). At this conference it was decided to change the name of the Union to ' The International Union for the Conservation of Nature and Natural Resources ' or I.U.C.N. The immediate reason for doing this was to attract wider interest and financial support from Governments and other bodies, many of which have been indifferent to an organisation which apparently aimed no further than to ' keep out man, the greatest pest '. The new name makes room for the wise use of living nature and renewable resources.

Technical meetings were held to discuss a large number of papers submitted under four themes. Theme I, for which Dr F. Fraser Darling was Rapporteur, dealt with ' The management of Nature Reserves on the basis of modern scientific knowledge'. The common threads running through a series of contributions by foresters, biologists, National Park and nature reserve managers and promoters, mainly from Europe, North America and Africa, were 1.—man as part of nature, either as an interfering agent of instability as stressed by Dr Darling, or as a traditional maintainer of landscape stability and beauty according to Professor Rommel of Sweden, or as a swelling throng bent on recreation and education as mentioned by Dr Gabrielson with reference to National Parks in U.S.A. ; 2.—details of plant and animal communities in various reserves and the value of these reserves as field laboratories ; 3.—insufficiency of scientific knowledge and the need for greater exchange of information and experience applicable to conservation. At a plenary session of the Conference papers were presented for the first time in the Union by representatives of the Soviet Union. Professor Dementiev, head of a new Commission for the Protection of Nature in the Academy of Sciences of the U.S.S.R., spoke about the far-reaching measures taken in the conservation and exploitation of nature, with particular reference to animal life. Dr Shaposhnikov, of the same Commission, described the economic, scientific and educational activities in the natural parks so far established in the U.S.S.R. Dr Malinovsky of the Ministry of Agriculture dealt with the use of forest belts for the protection of soils, water, crops, railways and human health.

In Theme II papers were submitted on ' Biological effects of the recent spread of myxomatosis among rabbits ' in Australia and Western Europe. The Rapporteur, Professor Bourliere of Paris, concluded that the effects of myxomatosis on the fauna and even more on the vegetation, were as spectacular as its action on wild rabbit

populations. From the point of view of Nature Protection, and also of agriculture, it seemed quite certain that these effects, after all is said and done, were beneficial. On the other hand, complete extinction of the wild rabbit seemed to be out of the question. Theme III, ' The rehabilitation of areas biologically devastated by human disturbance ', was covered by a large number of papers (mostly from this country, West and East Germany, Sweden and the Netherlands) on which the Rapporteur was Dr Engelhardt of Munich. About half of these dealt with the damage done by mining and other extractive industries and the methods by which it is possible to restore the landscape to agricultural, forestry or other uses. The other half dealt with various forms of devastation, due for example to erosion and to military operations ; in some cases, as indeed at various other points in the Conference, no clear distinction was recognised between devastation due to or accelerated by man and that due to the normal physical processes of nature. Many of the papers contained a wealth of valuable information based on practical experience, and they point the way to the more active steps in rehabilitation which still require to be taken in Scotland.

In Theme IV, ' The relationship of ecology to landscape planning ', a large and varied series of papers were contributed and spoken to by soil and water conservationists, foresters, botanists, geographers, regional planners and landscape architects. One common thread was the principle enunciated by E. H. Graham of the Soil Conservation Service, U.S.A., that nature protection is fully effective only when it is an integral part of the land and water development programmes which are characteristic of the modern world-wide technical revolution. Another aspect was the mutual and urgent interest of both town and country in conservation in densely populated areas such as the Clyde Valley, and a third was the importance of the recognition and use in development of what were variously called geo-botanical sites, habitat tracts, natural areas, or land capability guides. Allied to this was the call for more ecological research and survey. Striking examples of the subject of this theme being put into practice were given in the maps and slides shown by the Rapporteur, Dr Benthem, Chief of the Landscape Department in the State Forest Service of the Netherlands. F. H. W. Green of the Nature Conservancy spoke on the results of basic research on mountain climates in Great Britain, Dr Joy Tivy on ecological principles relevant to the planning of upland areas, particularly in Scotland, Dr Arthur Geddes on the Reconnaissance Vegetation Map of Scotland and Dr R. M. Gorrie on soil erosion and river regimes in the Highlands.

A number of tours, mainly illustrating Theme I, were organised to the Southern and North West Highlands, where many were dismayed by the degraded condition of the land. Shorter visits were arranged to parts of Midlothian and East Lothian in connection with Themes III and IV. Resolutions drawn up at the Technical Meetings or by the Union's various standing Commissions were passed by the General Assembly, for action either within the Union or to be brought to the attention of Governments and national or international bodies such as U.N.E.S.C.O. and F.A.O. These mainly concerned the survival of threatened animal species, practices in certain nature or game reserves, education and the foundation of a Youth Federation, natural resources in relation to the world's growing human population, the disposal or treatment of mineral spoil, the greater study and use of ecological principles by agencies carrying out landscape and land use development, and the general need for more research and exchange of information and experience. Some of these topics will be considered at the next conference of the Union, which is to be held in Athens in 1958.

I.U.C.N. is clearly a body which has been promoting and applying research on many aspects of natural environment, and is now attempting to move forward into the broader operational field which Patrick Geddes called " geotechnics ". Support has come so far mainly from biologists but the ecological approach is one shared and indeed pioneered by geographers, who might well take a greater part than has hitherto been apparent, or perhaps possible. They would gain from these contacts and could help to give the Union a clearer appreciation of the significance of the *physical* habitat and a fuller regional perspective of man's place in nature. In the words of E. M. Nicholson, Director of the Nature Conservancy, in his paper in Theme I " It is urgent to lower the barriers between those working under different labels and banners in the field of nature conservation." F. D. N. S.

THE SHIPMENT OF PETROLEUM TO AND FROM THE PORTS OF THE UNITED KINGDOM

HENRY REES

THE tanker fleet of the United Kingdom is now the largest in the world, and petroleum is entering increasingly into the traffic of many British ports. These are developments of only the last few years and a new pattern of coastal and overseas petroleum traffic is emerging.

Three companies virtually control the refining of oil in this country —the British Petroleum Company (formerly Anglo-Iranian), the Shell Petroleum Company and the Esso Petroleum Company (Table 1).

Refinery	Company	Capacity, in million tons
Fawley (Southampton)	Esso Petroleum	7·5
Stanlow (Manchester Ship Canal)	Shell Petroleum	4·55
Isle of Grain (Rochester)	British Petroleum	4·6
Llandarcy (Swansea)	British Petroleum	3·0
Shell Haven (Thames)	Shell Petroleum	3·33
Grangemouth	British Petroleum	2·2
Heysham (Lancaster)	Shell Petroleum	1·8
Coryton (Thames)	Vacuum Oil	1·0

Table 1. Refineries with an average capacity of more than 200,000 tons per annum at the end of December, 1955. *Source :* Petroleum Information Bureau.

The Esso refinery at Fawley was opened in 1951 ; the Kent refinery on the Isle of Grain began operating in 1953 ; the Coryton installation of the Vacuum Oil Company dates only from 1954. Other plants have been modernised and enlarged so that British refinery capacity, which in 1938 totalled only 2·5 million tons, had by the end of 1955 reached a total of 28·9 million tons. In 1954 the United Kingdom was the greatest refiner in Europe and held fifth place in the world.

Large tanker fleets supply these refineries and rank among the biggest marine enterprises in existence. The fleet of the British Tanker Company, which supplies the three refineries of the British Petroleum Company, comprises 148 vessels. Shell Tankers Ltd operate 103 vessels and the Esso fleet numbers more than 30. These ocean-going tankers vary in size from about 8,000 to over 30,000 tons d.w. Each tonnage range has its special use. The smallest carry refined products to ports with restricted accommodation. The 12,000- to 14,000-tonners are general purpose vessels ; 16,000-tonners supply the chief industrial markets of Great Britain, and the largest vessels (supertankers) are designed chiefly for the carriage of crude oil to Britain from the Middle East. The modern supertanker is a magnificent ship ; it has a length of about 600 feet, a draught of 32 feet, and reaches a speed of 16 knots.

This discussion is limited to a sample of the United Kingdom traffic, which represents only a part of the web of world connections woven by British tankers. In the reports of a specimen period of five successive days (30th May-3rd June 1955), of a total of 442 British tankers mentioned, only 167 were either at or were proceeding to or from United Kingdom ports.[1] The distribution of these vessels was related not only to the location of the refineries, but also to that of the chief consuming regions, for where petroleum products are required in large quantities it is economical to supply them by ocean tanker direct from the refinery.

The long distance traffic—the trade between the United Kingdom and non-European ports—may be considered first. During the period under review there were seventy-nine connections which fell within this class. Most of them were related to the carriage of crude oil from the producing region to a British refinery ; but a considerable number implied the reception of refined products at a major centre of consumption.

The Southampton area was outstanding in importance. Here are situated not only the greatest refinery in the Commonwealth, at Fawley, but also the installations of the Shell and British Petroleum companies at Hamble. The Fawley refinery can accommodate four supertankers at once and about 7,000,000 tons of crude oil arrive there annually. Of the nineteen connections reported there, fourteen were with the Middle East and only five with the Caribbean. The round trip to the Persian Gulf and back takes about forty days : thus, the *Esso Westminster* left Mena al Ahmadi in Kuwait on the 18th of May ; she sailed round Arabia in six days, was reported at Suez on the 24th of May and was due at Fawley on the 5th of June. Oil from the Caribbean takes rather longer to reach the United Kingdom—about twenty-two days. On these voyages no time is wasted and a tanker rarely stays more than a day in port. Second in importance to the Southampton area was Llandarcy, with five Middle East connections and two Caribbean.

In contrast, the main centres of consumption—the Clyde, Tyne, Humber and Thames—received their refined products chiefly from the Caribbean—from Curaçao (ten connections) and Trinidad (six connections). Eight links were reported between the Tyne and Mena al Ahmadi ; but in fact these all related to outward sailings, presumably in ballast, of vessels which had previously delivered coastwise cargoes from home refineries. A single tanker, the *Corato*, connected directly with the United States. She came from Houston, an important refining centre on the Gulf of Mexico, berthed at Saltend (Hull) and proceeded to Jarrow, no doubt sharing her cargo between the two. A second tanker had crossed the Atlantic from Lake Charles, an oil refining centre in Louisiana, and was apparently sharing its cargo among the installations at Havre, Thameshaven and Purfleet.

Many ocean tankers, after discharging their crude oil at the refinery, load with refined products and distribute them coastwise before returning to the Middle East. Large-scale coastal traffic of this nature is virtually limited to three consuming regions—the Tyne, the Humber

and Avonmouth. During the period under review each was visited by eight ocean tankers travelling coastwise. The Humber ports (Saltend and Immingham) and the Tyne were supplied from Grangemouth and the lower Thames; Avonmouth was supplied by Fawley and Llandarcy. In addition, the requirements of the Tyne appear to have been supplemented by imports from Rotterdam.

Overseas shipments from Britain were virtually confined to European destinations, and only four vessels appear to have carried refined products to distant ports (to Surabaya, Mauritius, Dakar and 'West Africa'). The chief element in the export trade was the shipment of refined products to Scandinavia, in particular, Denmark (seven connections). Grangemouth received a tanker, presumably in ballast, from Sundsvall in central Sweden, and the Isle of Grain one from Malmo.

From the major terminals which are served by ocean tankers, coastal vessels redistribute petroleum products to the smaller bulk installations. For this purpose Shell-Mex and British Petroleum Ltd, the joint marketing organisation for Shell and British Petroleum products, operate a fleet of thirteen vessels (neglecting those under charter), while the fleet of the Esso Petroleum Company numbers seven. Five other shipping firms maintain tanker fleets, totalling at least thirty-six vessels. Coastal oil tankers vary in size from below 200 to about 1,000 gross tons, and in the modern vessels as in their larger sisters a high standard of accommodation is reached.

Reports of coastwise traffic for the 14th and the 15th of March 1955,[2] for instance, draw attention to the existence of many smaller coastal oil depots, which tend to be supplied from the nearest refinery or major installation. Ipswich and the south coast are supplied chiefly by Fawley; the Irish ports, where the demand is insufficient to warrant the use of ocean tankers, are supplied from Llandarcy and Stanlow. The Grangemouth refinery has a wide range, from Kirkwall in Orkney to Saltend on the Humber. Since the Tyne is already supplied by ocean tanker, there is no need for oil products to enter by coaster; on the contrary, the Tyne itself supplies Aberdeen. The lower Thames serves Keadby on the lower Trent, King's Lynn, Ipswich and Portslade (though there were no tankers reported there during the two days reviewed); it also connects with Guernsey.

These coastal depots, linking coastal tanker with road wagon, play an important part in the distribution of petroleum products. Each includes large tanks for the storage of some seven varieties of petroleum spirit, and a pump house for their transfer from storage tank to lorry. Thus the Shell-Mex and British Petroleum depot at Inverness contains five large and three smaller storage tanks, served by nine main pumps; it supplies a large area of north-west Scotland. That at Workington has eight large and eight small tanks and nine pumps; it serves the industrial area of the north-west coast and the rest of Cumberland. Portslade supplies the large visiting population of the south coast resorts and the rest of Sussex; it contains eleven large and seven small tanks, and thirteen pumps.

During the last five years or so the growing traffic in crude oil and

refined products has profoundly changed the nature of the trade in many British ports. The Port of Southampton includes both Fawley and Hamble and in 1954 the petroleum tonnage handled there was seven times as great as that of all the other goods combined (Table 2).

Petroleum traffic (coastwise and overseas) .	Imports	7,788,997
	Exports	6,341,253
	Total	14,130,250
All other goods . . .	Total	2,028,280

Table 2. Port of Southampton : petroleum and all other goods traffic during 1954 in tons. *Source :* Southampton Harbour Board.

In the lower Medway the petroleum trade has quite over-shadowed the traditional paper making and cement manufacturing activities. During June, 1952, petroleum accounted for 33 per cent of the total tonnage handled in the Port of Rochester (which includes the Isle of Grain). Within two years, and largely owing to the construction of the Kent Oil Refinery, the total tonnage of goods handled in the port had multiplied seven-fold and the share of petroleum had risen to 88 per cent (Table 3).

		Petroleum	Total traffic
June 1952	Imports . .	29,077	92,631
	Exports . .	2,756	4,804
	Total . .	31,833	97,435
June 1954	Imports . .	419,256	498,049
	Exports . .	231,894	239,383
	Total . .	651,150	737,432

Table 3. Port of Rochester : petroleum and total traffic during the months of June 1952 and June 1954 in tons. *Source :* Medway Conservancy Board.

In 1954 petroleum accounted for 88 per cent of the total imports of Swansea and 58 per cent of the exports ; at Grangemouth it represented approximately 50 per cent of the total trade. In Bristol petroleum was the greatest single item on the trading list, accounting for 38 per cent of the total tonnage handled ; it was by far the leading import of Hull, amounting to 32 per cent of the tonnage imported.

The oil traffic is still growing. Refineries are continually being extended and depots reorganised. In 1954, the largest oil dock in the United Kingdom was opened at the entrance to the Manchester Ship Canal. New tankers are constantly being launched : in 1954 the Shell company alone had twenty-two ocean vessels on order or under construction ; in the autumn of 1955 the British Petroleum Company

British Petroleum Company Limited

Pl. 3. THE BRITISH PETROLEUM COMPANY'S 32,000-TON TANKER, *BRITISH SAILOR*
Discharging crude oil at the Company's Finnart Oil Depot, Loch Long. From here oil is pumped along the 57-mile pipe-line to the Company's Oil Refinery at Grangemouth on the Firth of Forth.

Polar Photos.

Pl. 4 (See p. 113). VAHSEL BAY—WEDDELL SEA

The crevassed ice wall or ice cliff in the background stands some 80-100 feet high and forms the seaward margin of the inland ice sheet: A 'bergy bit' (left) and a decaying berg (right) broken from the ice wall, are now held fast in heavy sea-ice; in the foreground are *shrader (sastrugi)*, the wave-like formations produced

ordered twenty-three new super-tankers. A vessel of 47,750 tons d.w. and a length of 757 feet has already been launched.[3] This is clearly a period of rapid change in the petroleum shipping industry.

[1] The movements of British ocean tankers are reported each Monday in the *Journal of Commerce and Shipping Telegraph*. This account is based on the reports of Monday, 30th May 1955, supplemented by further information published on the four succeeding days.

[2] The reports used were those of the coastwise section in *Lloyd's List and Shipping Gazette*, published Monday and Tuesday, 14th and 15th March 1955. These do not distinguish tankers from dry-cargo vessels, and it is possible that a few tankers have been overlooked.

[3] The Japanese have a tanker of 83,000 tons under construction.

INTERNATIONAL ACTIVITY IN ANTARCTICA 1955-56

The sudden expansion in the Antarctic activity which has taken place during the southern summer of 1955-56 is, for Great Britain, largely associated with the Commonwealth Trans-Antarctic Expedition Reconnaissance and the Royal Society's International Geophysical Year Expedition, both focused on the Weddell Sea area (Pl. 4).

The Commonwealth Trans-Antarctic Expedition

It is natural that this Expedition should have first mention since the Royal Scottish Geographical Society was, some forty-six years ago, closely associated with the ideas that lie behind it. Historically the Expedition has its roots in a meeting of the Royal Scottish Geographical Society of the 17th of March 1910, when W. S. Bruce, leader of the successful Scottish National Antarctic Expedition of 1902-04, proposed that a trans-continental journey should be made. His plans only differed from those of Dr V. E. Fuchs in that it was intended to descend the Beardmore Glacier (the route of Shackleton and Scott towards the South Pole) in order to reach McMurdo Sound (Fig. 1).

The purpose of the present Expedition is to cross the Antarctic continent from the Weddell Sea to the Ross Sea, carrying out a wide scientific programme on the way. The crossing, led by Dr Fuchs, will be made by tracked vehicles (Sno-Cats) with dog teams and aerial reconnaissance in support, while Sir Edmund Hillary, setting up the New Zealand base at Butter Point at the foot of the Ferrar Glacier on the west coast of McMurdo Sound, will lay a depot and will meet the crossing party near Mt Albert Markham or further south. By deciding to pass to the west of the Victoria Land mountains, where the New Zealand party will carry out topographical and geological surveys, a further unknown stretch has been added to Bruce's route.

Although Bruce was unable to raise funds for his plan and although he handed over the leadership to Shackleton whose Expedition of 1914-16, on both sides of the continent, was beaten by sea-ice conditions, it was very fitting that at the Usher Hall in Edinburgh on the 3rd of April 1956, Dr Douglas Allan, President of the Royal Scottish Geographical Society, should present the flag of the S.N.A.E. 1902-04 to Dr Fuchs : it relates Bruce and the many Scots who supported Shackleton, closely with the present Expedition. At this meeting in Edinburgh, and on the 4th of April in Glasgow, Dr Fuchs and Sir Edmund Hillary spoke to audiences of the Society on the experiences of their reconnaissance journey.

The Expedition left London in the 829-ton ice-strengthened Canadian sealer m.v. *Theron* on the 14th of November 1955, and, via Montevideo and South Georgia, reached the ice edge in the Weddell Sea in latitude 63° 30′ S longitude 31° W on the 22nd of December.

In ignorance of the ice situation in the Weddell Sea, it had been planned that the *Theron* would lay a course direct from South Georgia to the Caird coast a hundred miles south-west of Kapp Norvegia. If ice was met which barred easy southward progress then easting would be made. For five days the *Theron* was, as it transpired, lured southwards at good speed through open pack, pools and leads. Although the ice was becoming heavier and there was less open water, good progress was still being made to the south when, on the 27th of December, impenetrable ice lay ahead. An attempt was made to extricate the ship eastwards but a strong north-east wind consolidated the pack. There followed a period of twenty-six days during which the crew of the *Theron* under Captain Marø and members of the Expedition made valiant efforts to keep the ship free and gradually move her north. Meanwhile the prime mover was the clockwise circulation of the ice in the Weddell Sea, which, under the influence of the strong prevailing easterlies, finally allowed the *Theron* to reach open water in approximately 66° 30′ S, 31° 40′ W.

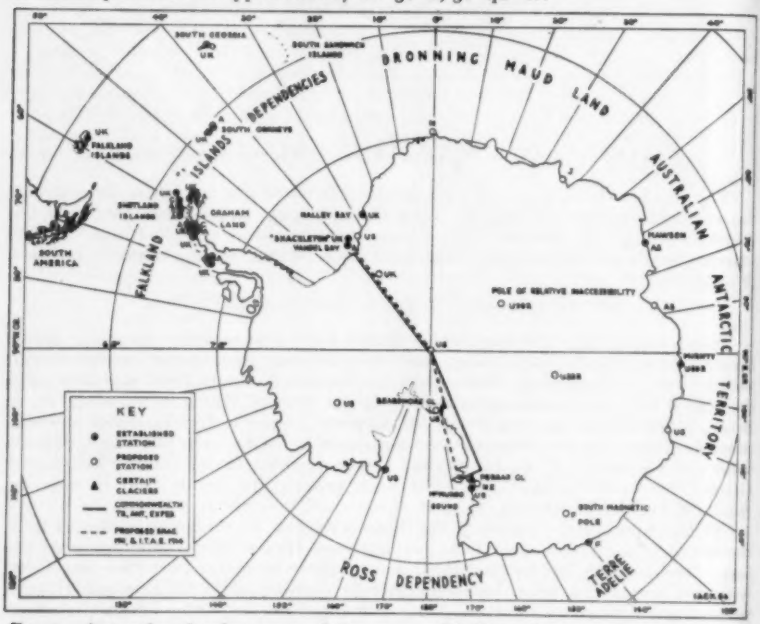


FIG. 1. Antarctica showing route of Commonwealth Trans-Antarctic Expedition and that proposed by W. S. Bruce for the Scottish National Antarctic Expedition, 1911, and that attempted by the International Trans-Antarctic Expedition, 1914. International Geophysical Year bases: A=Argentine, As=Australia, C=Chile, F=France, J=Japan, NZ=New Zealand, N=Norway, UK=United Kingdom, US=United States of America, U.S.S.R.=Russia; those bases on sub-Antarctic islands are not shown.

Meanwhile the m.v. *Tottan*, with the Royal Society's party heading for Kapp Norvegia and warned by the *Theron's* experience, entered the Weddell Sea on a more easterly longitude. Later the *Theron* followed this course through more open water, to Halley Bay, the Royal Society base on the Caird coast, in latitude 75° 29′ S longitude 26° 36′ W.

The problem now facing the Trans-Antarctic Expedition was to find a point where stores could be landed along a coast which is almost entirely ice cliffs 60-100 feet high and at a point where the overland way to the south seemed clear. After aerial reconnaissance Halley Bay was ruled out because of the encircling lines of crevasses in the ice shelf and a decision was made in favour of a point twenty-five

miles west of Vahsel Bay in latitude 77° 59′ S longitude 37° 16′ W which the ship reached on the 29th of January.

Although much hampered by very poor weather, but spurred on by the impending threat of the ice lying to the north of the ship, the stores were landed and aerial reconnaissances were made of a satisfactory route to the south before the *Theron* was forced to depart from ' Shackleton ' Base on the 7th of February.

The return voyage was uneventful and despite the later loss at ' Shackleton ' of some supplies during late March, the necessary pioneering of the southward route will be made in the southern spring in readiness for the crossing which is due to start in November 1957.

During the course of the Trans-Antarctic Expedition some 2,000 miles of as yet unexplored territory will be traversed on the ground and scientific work will go hand-in-hand with a topographical survey on a scale of 1:200,000. The scientific purposes of the Expedition include a seismic traverse of the continent to measure the thickness of the polar ice-cap and to give a profile of the underlying land surface ; a gravimetric survey ; meteorological observations ; geological, glaciological and physiological studies. The programme is wide but most of the subjects are closely related. A great merit of many of these tasks is that they will be carried out continuously across the continent, and will prove of outstanding value when the results are combined with similar work carried out at static bases scattered over the continent in the course of the International Geophysical Year ; most of the new I.G.Y. Antarctic bases will be set up in the Antarctic summer of 1956-57, although some were established last season (Fig. 1).

International Geophysical Year, 1957-58

The purpose of this year which will run from June 1957 to December 1958, is that simultaneous observations of natural phenomena shall be taken at stations in the Polar regions, the Tropical belt and along the meridians 70°-80° W, 10° E, and 140° E : the year was chosen as coinciding with a period of sunspot maximum. The scientific programme includes studies of meteorology, geomagnetism, aurora, airglow and zodiacal light, cosmic rays, solar observations, ionospheric investigations, determinations of latitude and longitude, glaciology, oceanography, seismic and gravity measurements and a programme of rocketry.

Although forty-three nations are taking part in the I.G.Y. only eleven of these will be working in the Antarctic. These include : Argentina, Australia, Chile, France, Japan, New Zealand, Norway, South Africa, the United Kingdom, the U.S.A. and the U.S.S.R.

The Royal Society Antarctic Expedition, under the leadership of Surgeon Lt-Cmdr D. Dalgleish, left this country in the Norwegian ship m.v. *Tottan* on the 22nd of November 1955. It had been planned that the Royal Society's and the Trans-Antarctic bases should be adjacent, but in early January the *Tottan* found it impossible to break through to Vahsel Bay ; she therefore retraced her tracks to a bay in the shelf ice on the Caird Coast, naming it Halley Bay after the eighteenth-century Astronomer-Royal. Additional interest has been given to the site by the discovery nearby of the sixth-known Emperor Penguin Rookery. Next season the Royal Society will share the m.v. *Magga Dan* with the Trans-Antarctic Expedition.

The Australian National Antarctic Research Expedition has been carrying out a long-term programme of scientific research on the sub-Antarctic islands of Heard (closed 1954) and Macquarie since 1947. In addition to the latter permanent base the Expedition set up a base on the coast of MacRobertson Land, in February 1954, and named it after the well-known Australian Antarctic explorer Sir Douglas Mawson. In February this year a reconnaissance was made of the Vestfold Hills area, some 400 miles east of Mawson with a view to setting up a base there next year.

The U.S.S.R. have been active in the Australian sector of Antarctica having established the main base ' Mirnyy ' for their I.G.Y. programme. Since then their icebreaker research vessel *Ob'* has carried out extensive oceanographical work in the Davis Sea and has paid a courtesy visit on the Australian base at Macquarie Island. On the 2nd of April 1956, a party left ' Mirnyy ' to set up a base 220 km away en route for the South Geomagnetic Pole. It is not clear whether it is intended to set up a permanent base at this site, but it is interesting as one of the few examples

of a polar plateau winter journey. They propose to establish one farther base at the so-called 'pole of relative inaccessibility'.

At present (June 1956) news of what the United States I.G.Y. Expedition has accomplished is not complete but it appears that two bases have been successfully built and occupied—in McMurdo Sound and on the west side of the Ross Ice Shelf. Apart from this they have also undertaken an intensive flying programme by long and short range planes. It is hoped that during the I.G.Y. there will be American bases at the Geographical Pole, in Marie Byrd Land, on the coast of Knox Land and near the Weddell Sea, with a further logistic base at the foot of the Beardmore Glacier.

Expeditions Polaires Françaises arrived at Isle de Pétrels off Pointe Geologie, Terre Adélie on New Year's Day, 1956. It is to re-occupy the base site, on Isle de Pétrels, of the 1952-53 French party which had its huts burnt down. This time prefabricated metal hutting made largely of aluminium will be used—a revolutionary departure from the normal Antarctic hut design. A satellite base is also to be set up by 'Snocat' at the South Magnetic Pole in October 1956.

Of the other countries Argentina and Chile are occupying eight and four bases respectively in the area of the Falkland Islands Dependencies. The scientific programme at these existing bases will be adapted to meet the requirements of the I.G.Y.; no further bases have been proposed. New Zealand, South Africa, Norway and Japan have still to establish their bases. The New Zealand contribution (organised by the Ross Sea Committee) is a combined base to serve the needs of the I.G.Y. and to act as Sir Hillary's base for the Trans-Antarctic Expedition. The South African bases are on the sub-Antarctic islands of Marion and Tristan da Cunha; another is to be established on Gough Island. Norway and Japan are to set up their bases in Dronning Maud Land.

Finally, the *Falkland Islands Dependencies Survey* which started as 'Operation Tabarin' in 1943 now occupies ten bases with seventy-six men, in the South Orkney Islands, the South Shetland Islands and on islands off the west coast of Graham Land. The purpose of the Survey is geographical discovery, topographical mapping and scientific research: maps of Graham Land and the adjacent island groups have been produced on scales varying from 1:500,000 and 1:200,000 to 1:10,000. On account of difficulties encountered in the surveying of the interior plateau of Graham Land and certain coasts, it was decided to couple aerial survey with ground control. The F.I.D. Aerosurvey Expedition (Hunting Aerosurveys Ltd) started operations in January 1956. Although hampered by poor weather, by using a helicopter to land survey teams on inaccessible islands and mountain tops a major triangulation was carried from Deception Island to Graham Land.

Eight of the bases occupied by the F.I.D.S. are full-scale meteorological stations reporting to the forecasting of off ice at Stanley in the Falkland Islands by radio every three hours. Six of these stations will be adapted to meet the requirements of the I.G.Y. programme. Last season two new bases were established off the Danco Coast and at the mouth of the Lallemand Fjord, as bases for topographical and geological surveys. Other work on zoological problems, on geomagnetism and on the distribution of sea ice is also in progress at the various stations.

For the last seven years the Survey has used as a supply ship the Royal Research Ship *John Biscoe* but she has now finished her southern voyaging under that name and has been purchased by the Ross Sea Committee in New Zealand for the Trans-Antarctic Expedition. Last year the Survey purchased and modified the *Arendal*, of 1,102 gross tons, from Norway and renamed her the R.R.S. *Shackleton*, and on the 11th of June this year a new *John Biscoe* of 2,200 tons dead-weight was launched at Paisley and will be ready for work next season.

In conclusion it is interesting to note that personnel for many post-war expeditions have had their basic training with this Survey: many of those now with the Trans-Antarctic and the Royal Society Expeditions gained their first field experience with F.I.D.S.

JOHN HEAP.

POPULATION PRESSURE AND MARGINAL LANDS: A Review

J. W. Watson

In his inaugural address to the Geography section of the Australian and New Zealand Association for the Advancement of Science,[1] Professor Griffith Taylor has compared the resources of Australia and Canada mainly from the point of view of the peopling of these countries. In this he has brought forcefully to our attention the whole problem of population growth and the role of the marginal lands. Population has grown so much that even the sub-arctic fringe of Europe, and the semi-arid fringe of Asia are relatively thickly settled. Startling indeed are the contrasts between these areas and their climatic homologues in north-west Canada and in north-west Australia: whereas Scandinavia and northern Russia have a population of about 30 million people, the same area in Canada, with roughly the same build and climate, has less than half a million. The semi-arid edge of the tropical monsoon area in China offers even more glaring contrasts with its counterpart in Australia.

The United Nations Organisation (*Demographic Yearbook 1954*) estimates that global population is increasing at the rate of about 20 millions per year, or 200 millions per decade. Taking the mid-century total to be 2,400 millions, the end-of-the-century total would be as high as 3,400 millions. Since the death rate is being lowered considerably, while the birth rate remains undiminished, the actual total could be appreciably more: probably not less than 3,500 millions. Sir Charles Darwin[2] places it as high as 4,000 millions: he goes on to point out that while the population is at present increasing at just over 8 per cent per annum, the world's food supply is only growing at the rate of 6 per cent per annum. In fifty years' time the disparity between people and food will have grown to grave proportions. In the face of such prospects it is more than ever necessary to examine the marginal areas of the earth and to assess population-carrying capacities.

Griffith Taylor tries to summarise both the main limitations and opportunities of Australia and Canada. Their limitations are briefly: that both countries have a marginal position, Australia more so than Canada; both countries have large areas rendered unsuitable to agriculture—600,000 square miles in Australia, or over one quarter the total, and 800,000 square miles in Canada, or not quite one-fifth the total; both have a substantial amount of rugged terrain, about one-sixth of Australia and one-seventh of Canada being mountainous. Canada is less favoured climatically than Australia, only a small part of the country falling within the world's 'comfort zone', whereas the greater part of Australia lies inside this. The opportunities of the two Dominions are: that each has plenty of living room, being among the larger countries of the world; both possess extensive areas of 'shield' land, rich in metals and other minerals—Taylor puts the Australian shield at 1·7 million square miles and the Canadian shield

at 2·5 million square miles ; both have considerable reserves of coal, while Canada owns, in addition, valuable quantities of oil and natural gas. Griffith Taylor does not add, though it should be included, that both were colonised relatively recently by people mainly of British origin, having high technological and social standards.

Too much attention may be focused on the physical limits to settlement, and these are often set out with too great finality. Physical limits, desert and high mountain, do inhibit colonisation ; but the recognition of these limits, their effectiveness and extent, vary with social ends, technological means and the stage of economic development. Professor Taylor appears to ignore this. With one notable exception he eschews what might happen were the present society or economy to change. He does, however, point out that, were the White Australia policy to be revised, that country might carry what regions with similar climate and soil can and do bear in China or West Africa.

He spends much of his address reviewing his own and other people's estimates of what is semi-arid and arid Australia, or what is sub-arctic and arctic Canada. One is surprised that in his survey, Professor Taylor has not mentioned Peveril Meigs's report on the world's arid areas, made for the U.N.E.S.C.O. commission on the hydrology of arid lands. Meigs places rather more of Australia in the dry zone than do Taylor, Köppen, De Martonne and Thornthwaite. There is something to be said for this. Ecological indices include more under the term semi-arid than do strictly climatic ones. The desert ' complex ' often spreads further than the desert. Certain methods of herding and farming render sub-humid areas of no more effect than semi-arid ones. Futhermore, such cultures have let in the semi-arid on the sub-humid areas. In Canada, for instance, overgrazed shortgrass prairie, or prairie inefficiently farmed, has not infrequently degenerated to near desert.[3] Modern practices have taken this into account, and do not attempt to carry over essentially humid cultures into sub-humid zones. On the contrary there is the tendency to develop semi-arid cultures in sub-humid areas, and thus avoid the deterioration of the land. For this reason the dry cultures may perhaps extend beyond the dry margins. Dry farming in Canada occurs outside Köppen's dry region

Of course, conditions change with fluctuations of the climate. In wetter than usual years a humid-type farming encroaches on what, from the long-term point of view, must be regarded as semi-arid or arid lands. The difficulties, not to say disasters, that may follow when drought returns, are persuading more and more people to regard these zones of fluctuation as a part of the dry margins. Professor Taylor claims that the zone of fluctuation is not significant in Australia. That has not been the case in North America. The study on *Prairie Population Possibilities*, by W. J. Waines, published in connection with the Rowell-Sirois report of 1947, indicated that the zone of fluctuation in Southern Canada was considerable and was deemed a greater hazard than drought itself. In other words people found it a more difficult matter to adjust to an area with a fluctuating regime than to truly dry regions. Thornthwaite brought this out admirably in his study of the settlement of the High Plains of the U.S.A.[4]

For these and other reasons it might be argued that the human geographer should decide on the limits of the dry zone rather than the physical geographer. This is even more true when it comes to the limits of the cold zone. Again, Griffith Taylor defines these limits mainly in relation to the existing society and stage of technology. But stage of development is fundamental. It could be said that the sub-arctic in Canada retreated at one bound with the discovery of Marquis wheat. In 1881, according to the Ontario Royal Commission on Agriculture, it was not considered safe to raise wheat where the July average fell below 65° F. ; twenty-five years later this margin of safety had been reduced to 60° F. In his memoir on Canadian boundaries Dr Nicholson shows that Alberta did not at first press for a boundary north of the sixtieth parallel because its leaders thought this coincided with the 60° F. isotherm, that is, with what was then considered the northern margin of settlement.[5] Subsequently, it has been shown that wheat can be raised as far north as the 55° F. July isotherm.[6] This, however, is not an economic limit and Griffith Taylor accepts the 59° F. isotherm. Should farming continue to become more scientific and efficient it is likely to make an even more satisfactory adjustment to cool conditions, and so to push back the sub-arctic front.

It was no doubt in the light of this that Dr Archibald, Director of Experimental Farms in Canada, was able to claim recently that there were still 250 million acres of land in northern Canada for cultivation or grazing. Subsequent soil surveys by Dr Leahy in the Mackenzie basin and in the Yukon would corroborate this, while the recent expansion in favoured areas along the northern fringe of the Prairies and in northern British Columbia would indicate that such optimism is justified.[7] However, one or two unfortunate setbacks in opening up the Ontario Clay Belt should warn us that the whole matter is a very delicate one, and open to argument.[8] A zone is being reached where the fluctuations of climate are such that areas may have to be treated as essentially sub-arctic though in good years they might be temperate enough. Rather than press ' temperate '-type farming to the limit, ' cold-type ' farming may have to be practised before strictly cold areas are reached.

The geographer should, perhaps, not be anxious to roll back the limits of the dry and cold zones too far. In all probability, settlement will not push out to the ultimate limits until major changes in economy take place. It is, therefore, misleading to draw limits that have no value in the foreseeable future. Much of southern Canada is susceptible to improvement, and will probably be colonised and developed in a more intensive way, before sufficient pressure arises in the population to drive families north. The north *is* developing and will develop, but not by a wide, deep penetration of settlement, but rather by a series of sporadic though well-placed and concentrated efforts.

It is an oft-forgotten fact that the so-called ' new ' lands are as likely to pass through the regular stages of growth as the old ones, and that such growth proceeds to dispersion by concentration. We have not seen a uniform increase of population in Britain from centre to margin : on the contrary the margins have frequently been drained

to feed the centre. It is only now after prolonged and excessive concentration at the centre that there is beginning to be a dispersal.

The same is true for Canada. There, an initial drive into the country tended to fill it up very rapidly. But it was filled up very loosely. As Canada grew there was an appreciable *retreat* from formerly occupied land, with an ever-increasing concentration on the really favourable localities. This retreat began as early as the 1860's in the Maritimes, was in full swing by the 1890's in Ontario, and is now showing itself in the Prairies.[9] We have then the anomaly of a country actively encouraging immigration yet giving up occupied lands !

Population will have to wait upon the mature development of the 'new' lands before it begins to spread back even to the present physical limits of settlement ; it will have to wait until concentration of industry and other forms of effort in favoured locations in the new lands have reached such a degree of congestion as to drive people outward. Concentration appears to be still going on in both Canada and Australia, where metropolitan development dominates the economy.

The truth is the present economy of both Canada and Australia militates against extensive settlement. Increased mechanisation of farming, lumbering and mining tends to produce more with fewer people.[10] Even where more land is taken in and more resources exploited there is no guarantee that more settlers will be required. Where the settlers are needed is in the towns and cities, from which development spreads outward. It is for that reason that the horizontal expansion of settlement depends so much on the vertical expansion of the economy. It is only as Australia and Canada secure the capital, skills, organisation, and social urge for a full-scale, diversified economy that they are likely to build up their secondary centres and move out to their geographic frontiers. Any idea of relieving world population pressures by opening up these and similar countries must take account of this fact. The extent of their expansion depends on its character. As Hoselitz has shown,[11] while Canada and Australia have always been and are expansionist countries—widening their capital by developing new resources and by taking in new territories—their past growth differs appreciably from their present one. Up till about 1900 their growth was essentially satellitic. They expanded by offering land first to British and then to other European peasants or yeoman-farmers, or by exploiting the lumber and mineral products needed by Britain. Consequently development was on a relatively primary and extensive basis. That being so people were spread thinly over a wide area.

However, as these countries developed more independent economies, as they sought to evolve a way dominantly of their own, as they left it to their own entrepreneurs to initiate industry and expand commerce, then they found it increasingly economic to concentrate efforts in optimum areas. People began to draw together into these areas, to make the most of their opportunities, and there was not the same impetus to spread themselves thinly over the land in extensive pursuits. Extensive pursuits came to be carried out increasingly by machines, saving manpower for more intensive efforts.

Perhaps, for that reason, the geographer should pay as much

attention to the better use and the greater concentration of settlement on the favourable areas of marginal countries as he does to the supposed physical limits of colonisation. At the very least, he should couple with his consideration of such limits, the ' build up ' which is required behind them to drive people out to them. In other words what we want to know is whether economic concentration has proceeded to such an extent in south-east Australia and in southern Canada as to dispose industry and commerce to advance outwards. We cannot have a frontier economy divorced from a metropolitan economy.

This in its turn depends on the world economy, and on the growing significance of once marginal countries in a world anxious for more resources and more markets. Griffith Taylor is right in claiming that Australia and Canada are both assuming greater significance. But they can only help the world population problem in so far as the world helps them to mature and grow in themselves. They are needed not by way of being safety valves on old engines, to help Europe blow off steam, but as new engines to take on their share of the world's business. The question we need to ask ourselves is whether, as new engines, they can get up enough steam of their own to do this. The answer would seem to be in the affirmative.

[1] TAYLOR, G. Australia and Canada: A Comparison of Resources. Presidential Address, Section P. *Proceedings of the Australian and New Zealand Association for the Advancement of Science*, 1955, pp. 277-315.

[2] DARWIN, C. *The Next Million Years*. London, 1952.

[3] EGGLESTON, W. The Short Grass Prairies of Western Canada. *Canadian Geographical Journal*, 1955, I (4): 134-145.

[4] THORNTHWAITE, C. W. ' Climate and Settlement in the Great Plains ', in *Climate and Man*, U.S. Dept. of Agric., Agricultural Year Book, 1941, pp. 177-187.

[5] Nicholson, N. L. The Boundaries of Canada, Its Provinces and Territories. Canada: Geographical Branch, Mines and Technical Surveys, 1954, p. 72.

[6] ALBRIGHT, W. D. Crop Growth in High Latitudes, *Geographical Review*, 1933, 23: 608-620.

[7] WATSON, J. W. The Pattern of Canada's Post-War Growth, *Geography*, 1954, XXXIX (3): 163-175. Archibald's and Leahy's estimates are here considered.

[8] LOWER, A. R. M. *Settlement and the Forest Frontier in Eastern Canada*. New York, 1936, see chap. 5, ' Lumbering and Farming: Rivals in the Laurentian Plateau '. The author indicates that it is the competition with lumbering rather than climate that inhibits farming. Frequently, farmers are sold marginal land. On this, they find the hazards of climate too great. " Men slipped away from the pines and rocks of the Laurentian Plateau as fast as they were put there " (p. 54).

[9] WATSON, J. W. Rural Depopulation in Southwestern Ontario, *Annals of the American Association of Geographers*, 1947, XXXVII (3): 145-154. While Ontario is given particular attention, the general problem of Canada's rural depopulation is considered.

[10] BAKER, W. M. A Reconnaissance Survey of the Saddle Lake District, Alberta. *Geographical Bulletin* (Ottawa), 1954, 5, 14-28. See pp. 19-20. " Such a drop (in the rural population) should not be read to indicate a deterioration in conditions, rather, it reflects an improvement. For it is the result of a better organisation of the land . . ." Homesteading is virtually at an end. Its place has been taken by farming methods that require large scale mechanised production. Hence the extension of the frontier does not mean a correspondingly great expansion of population.

[11] HOSELITZ, B. F. Patterns of Economic Growth. *Canadian Journal of Economic and Political Science*, 1955, 21 (4): 416-431.

SCOTLAND ON THE MAP

The R.S.G.S. in Glasgow celebrated its seventieth anniversary this year, and to mark the occasion, an Exhibition of Maps was held in the main hall of the Kelvingrove Museum from the 24th of March to the 22nd of April 1956. The general theme was the mapping of Scotland from early times to the present day. On display was a considerable collection of maps and pieces of apparatus forming an attractive chronological record of Scotland on the Map. While many of the exhibits were informative historical and social documents, their variety provided an impressive index of the manifold uses of maps. That the exhibition was well received was evident from the fine attendance at its opening by the Lord Provost of Glasgow and from the interest shown alike by members and by the general public.

In the catalogue of exhibits, notes and information, wherever possible, were provided about each item—date, cartographer, title, dimension, scale as well as acknowledgment of its source and/or owner. The maps were arranged in seven sections. The Early Section, covering the period up to 1745, showed the advancement in cartography from the old and imperfect maps of Scotland to the succession of improvements based on the Gordon-Blaeu outline. The maps of the Jacobite period, which exemplify the results of the first attempts to carry out organised and accurate surveys of the Highlands, made up the next section.

Prior to the completion of the large scale Ordnance Survey mapping of Scotland in the middle of last century, large scale plans were not infrequently prepared for specific purposes. Both for agricultural improvements and for road, canal and rail projects complete detailed surveys and plans were a necessity. These were undertaken by private land surveyors and a selection of their work formed another separate section. A book of maps of Finlayston Estate, prepared by Charles Ross, was on loan from Admiral Sir Angus Cunninghame-Graham, K.B.E., C.B. and a plan of farmland, in runrig lay-out, by the same surveyor was provided by Sir Ivar Colquhoun. In the same section were maps and textbooks on surveying by John Ainslie ; no other private surveyor was so skilled or so productive and his map of Scotland was of unprecedented accuracy.

The evolution of road maps was portrayed in a series of maps and mapbooks dating from 1654 to 1956. In spite of the considerable improvements resulting from three centuries of progress it was interesting to note how strikingly similar were the adjacent exhibits of Taylor and Skinner's Road Book and the modern route guides provided by the Automobile Association. In the section on charts, coast and river maps the most valuable item was the Portolan atlas dated 1542. In this fine, historical relic, Scotland appears—as was wont on not a few early maps—as an island. Another section was devoted to the cartography of the city of Glasgow and its neighbourhood. Little cartographic material exists for medieval Glasgow ; the maps exhibited were products of the last two centuries. This collection, however, provided an interesting social and economic account of Glasgow as a great urban centre. There were maps showing not only the rapid territorial expansion of Glasgow but also the appearance and growth of the industrial establishments of the city. Maps also recorded the conversion of the river Clyde from an island-blocked river to a major navigational channel and the evolution of Glasgow's road, rail and water communications.

A notable and fitting contribution to the Exhibition was the unit provided by the Ordnance Survey displaying copies of past and present Ordnance Survey maps drawn on a variety of scales. An exhibition of field records, prints and plates illustrated the highly technical aspect of making maps. There was also on view a selection of old and new surveying instruments used by the Ordnance Survey for triangulation and levelling.

The planning and organisation of the Exhibition on such a large scale entailed a great amount of work, and much guidance and co-operation were essential. For permission to make use of the Kelvingrove Museum, the Committee was most grateful to the Corporation of Glasgow and to Dr Stewart Henderson, the Director, who, along with his staff, was consistently helpful. To Lt-Col J. S. O. Jelly, Mr H. A. Moisley and Dr J. B. Caird, all of the Department of Geography at the University of Glasgow, the Committee was indebted for the collection and mounting of the exhibits and for the preparation of the catalogue. The occasion of the exhibition brought to light much fresh information ; the Royal Scottish Geographical Society is always grateful for information on any maps which will contribute, still further, to placing Scotland on the map.

GORDON RAE

REVIEWS OF BOOKS

EUROPE

Man and the Land. By L. Dudley Stamp. 8¼×6¼. Pp. 272. 52 figs. 35 colour, 46 black and white plates. London: William Collins, Sons and Co. Ltd (New Naturalist Series). 1955. 25s.

Under the exciting and sweeping title *Man and the Land*, Professor Stamp, in this his second contribution to the New Naturalist Series, sets out "to cover the story of man's interference with nature in Britain" and "to trace the hand of man in shaping the scenery as we actually observe it to-day". For such a formidable task, and one which should rightly be undertaken by a geographer, there is certainly none better equipped than Professor Stamp.

He develops his thesis in three stages, the first, occupying the first nine chapters (half of his book), "endeavours to present a series of brief word pictures to show successive stages in the development of what has been called the cultural landscape". Under a group of convenient historical periods he gathers together facts relevant to the geography of Britain, or parts of Britain, during these periods. As a result of this now all too familiar treatment, our glimpses of past cultural landscapes tend to become blurred and at times obscured by interesting but not always obviously relevant historical detail and by discursive descriptions and discussions of source material. As one reads a story that has now been re-told many times one cannot help wishing that Professor Stamp had abandoned the chronological approach and had attempted rather to explain the existing landscape, *starting with the present*, in terms of the past.

In the second stage, chapters 10-15, he analyses in more detail the characteristics, development and distribution of those elements which man has 'implanted' on the landscape—crops, domestic animals, orchards, woods and forests. In doing so Professor Stamp has collected together much interesting and new material; the two chapters on trees particularly are excellent both in content and treatment. Much of the rest unfortunately tends to read like an interesting agricultural catalogue; brief notes on numerous breeds of cattle, sheep and pigs, on goats, horses, guinea fowl, ducks, geese, turkeys, to some may be tedious, to others may merely serve to distract the attention from the main theme.

In the final stage, the last three chapters dealing with 'The Nineteenth Century', 'Towards National Planning' and 'The Second Elizabethan Age and the Future' give mainly a general resumé of those facts relevant to the study of the cultural landscape during the last 150 years—with special reference to the Ordnance Survey, the Land Utilisation Survey and the Planning Authorities and indications as to the changes of emphasis in land use. They leave one, however, with a sense of disappointment that, in fact, so little mention has been made of the urban landscape of Britain to-day. While admitting that in nine cases out of ten the 'typical' man in Britain would be a townsman, it strikes a rather odd note that Professor Stamp should postulate that "those features of the landscape which make up its greater part for the average man" are "the crop plants of the field, the trees of the orchard and plantations, the animals and birds of the farm", and thereby justify his emphasis on the rural landscape. In this latter respect, some of the numerous plates are more illuminating. Indeed one cannot speak too highly of the plates whose presence considerably enhance the value of this book. The maps and diagrams fulfil their purpose less satisfactorily—many have been seen before, many are never referred to in the text and hence their significance is lost.

While criticising the treatment of a difficult subject such as this—a subject open to many ways of interpretation—one must nevertheless be indebted to Professor Stamp for amassing in an interesting and readable book a wealth of material whose evidence should leave little doubt in the mind of the reader of the extent to which the landscape of Britain is a result of the hand of man.

J. T.

Rockall. By JAMES FISHER. 8¾×5¾. Pp. 200. 16 plates+coloured frontispiece. 12 figures. London: Geoffrey Bles, 1956. 18*s*.

Many seamen, fascinated by the island and its bird population, have told tall stories of Rockall. James Fisher, who sailed on H.M.S. *Vidal* with the expedition to annex Rockall, admits his own obsession with the tiny rock. Aided by excellent photographs and drawings, the author relates the island's story, sorting fact from fiction, before describing the ceremony in 1955 and giving a first-hand account of Rockall's natural history. A. R. P.

ASIA

Land of the 500 Million: A Geography of China. By GEORGE B. CRESSEY. 10¼×7¼. Pp. xv+387. 41 maps. 36 tables. 22 climatic charts. London: McGraw Hill Co. Ltd, 1955. 56*s* 6*d*.

This book complements the author's previous work, *China's Geographic Foundations* (1934) in space and time. Professor Cressey's use of contemporary data, communist and other, has brought this work up to date and has allowed a review in which impartiality is warmed by the human sympathy of one who knew China and its people for many years.

Chapters 1-7 review conditions as a whole; 8-13 summarise the outstanding facts within each region; and the final chapter sums up China's prospects. The simplicity of the style, enriched by vivid instances and linked to plentiful illustrations by land and air and to well-drawn, original maps, does not lessen the factual precision and careful assessment in generalisation of the book.

'China's Prospects' are reviewed from ten aspects, in terms of international co-operation, geo-strategy and internal development. China's regional position is excellent and offers "the geographic potentials to share leadership, a century hence, in the Pacific area with the United States". China's size permitted defence in depth, its over-all shape is coherent, and its area of continuous settlement compact, though plains are relatively small. Thus transportation is difficult. China's international boundaries are in dispute but the author gives sound reasons for China's need to control the fringing islands, including Taiwan (Formosa), for secure access to the ocean from its navigable rivers. For economic development China will need transportation by rail, heavy industry, improved agriculture and credit by help of exports. "500 million people are China's greatest asset, and her greatest problem" but her geography allows for "an important future". A. G.

AMERICA

The Urban Development in Southern Central Ontario. By Dr J. SPELT. 9½×6¾. Pp. 241. 20 tables. 25 maps and figures. Assen, The Netherlands: Koninklijke van Gorcum. Comp. N.V., 1955. Sewen f 17·50. Bound f 20.

Students of the historical geography of so-called new lands are happy in that the present cultural landscape has evolved almost entirely during the period covered by adequate written records; unhappily, satisfactory results do not invariably follow work on the available sources, since the ability to make use of these only occasionally accompanies an understanding of the natural landscape. Dr Spelt has, however, succeeded in working out, for that part of Ontario immediately to the north of Lake Ontario, an exceedingly detailed account of the settlement process, giving full weight to the influence of soils, climate and location on the choices made by the original European settlers, and has shown how these geographical factors have affected the subsequent development of towns and other centres of population, even where other considerations may have been more important in the beginning. This study, at once geographical and historical, is patently not for casual light reading; but the serious student, not only of Canada but also of other comparatively recently settled countries, will find it a valuable source of information and an excellent demonstration of method in historical geography. A. MACP.

LATIN AMERICA

Chile : An Outline of its Geography, Economics, and Politics. By GILBERT J. BUTLAND. Pp. vii+128. 7 maps. 1951. 12*s* 6*d*.

Brazil : An Interim Assessment. By J. A. CAMACHO. Pp. viii+116. 4 maps. 1952. 11*s* 6*d*.

Uruguay : South America's First Welfare State. By GEORGE PENDLE. Pp. viii+100. 2 maps. 1952. 11*s* 6*d*.

Colombia : A General Survey. By W. O. GALBRAITH. Pp. vii+140. 4 maps. 1953. 13*s* 6*d*.

Bolivia : A Land Divided. By HAROLD OSBORNE. Pp. ix+144. 4 maps. 1 climate chart. 1954. 12*s* 6*d*.

Ecuador : Country of Contrasts. By LILO LINKE. Pp. ix+173. 4 maps. 1954. 13*s* 6*d*.

Paraguay : A Riverside Nation. By GEORGE PENDLE. Pp. vi+115. 2 maps. 1954. 10*s* 6*d*.

Argentina. By GEORGE PENDLE. Pp. x+159. 5 maps. 1955. 12*s* 6*d*.

8¼×5¼. London and New York : Royal Institute of International Affairs.

The Royal Institute of International Affairs has now published eight volumes of its projected series of eleven on Latin American countries. With the exception of those on Argentina, Uruguay and Paraguay, all are by different authors. Each volume is a miniature compendium of information on the respective country but in the course of the five years over which the series has so far been published it has shown a distinct ' middle-aged spread ' in pagination, Miss Linke's *Ecuador* having swollen to 174 pages as compared with Mr Pendle's modest 100 pages for *Uruguay*. Increasing generosity of space rather than relative importance of the countries appears to be the operative factor. The authors seem to have been given their heads as regard general approach and relative weight assigned to the different aspects of the subject-matter and there is no uniform treatment even in the ' River Plate trilogy ', by Mr George Pendle. The most usual approach is the reference-book one of unrelated chapters on separate topics, but Argentina and Brazil are treated historically, while Bolivia and Chile have a partially geographical approach. Only one of the volumes is the work of a professional geographer, that on Chile, and this is distinguished by its maps as well as by its efficient handling of the economic material that occupies the greatest part of its space. The description of Bolivian landscapes by Mr Harold Osborne is of outstanding interest for the geographer. With the notable exception of Bolivia, however, it is either politics, mainly internal, or the general economy that receives the major attention. Excessive concern with politicians is an inheritance of its own past history from which Chatham House has not yet been able to shake itself free.

These countries provide a rich variety of suggestive contrasts in population, terrain and resource base. In Bolivia a very small minority controls a population that is 95 per cent illiterate and poverty-stricken in a land of great mineral resources, a situation that has been likened to " a beggar sitting on a chair of gold ". Eucador presents a massive " Indian problem " while in Paraguay the population is predominantly *mestizo*. In Brazil minorities originating from the early Portuguese settlers and from recent European immigration contrast with a mass of greatly mixed population, while Argentina presents the Latin American version of a European nation.

Large areas are economically inaccessible through high transport costs, as in Bolivia, Colombia and Ecuador, or even unexplored. In its earlier stages Paraguay was likened in its isolation to " an army on campaign ". Sharp regional contrasts in landscape have within individual countries their counterpart in economic and political sectionalism. In Argentina the fertile pampa is framed by the arid Andes

and by pastoral Patagonia ; one-third of Paraguay is well-watered plateau, the rest dry Chaco ; in Bolivia the altiplano contrasts on the one hand with the cordilleras, on the other with the tropical lowlands that make up three-fifths of its area ; in Ecuador the coastal zone contrasts with the Sierra and the half of the country that lies in the tropical lowland of Oriente. In the last-mentioned country the mercantile plutocracy of the coast has been resisted by the conservative landed interests of the Sierra. On a larger scale, in Argentine politics the sectional interests of the gauchos and the great urban development of Buenos Aires have been reflected in the conflicts of federalists and ' unitarians '. In Brazil the ambitions of the Paulistas as against the power of Rio de Janeiro are a matter of recent history. There has been a cultural contrast, too, sometimes with political reference, between the old sixteenth-century colonial cities in the oases of the Andes foothills and the new world-oriented metropolis of Buenos Aires, now in its extended administrative connotation comprising a population of 5½ million.

A characteristic feature of the economies of the Latin American republics has been dependence on the export of a few commodities—agricultural or mineral—and frequently only one. In Brazil there has been a succession of economic cycles of rise and decline—timber, sugar, cotton, coffee, the last having for a time a secondary cycle of rubber. In Ecuador the dominance of cacao from 1900 to 1914, when it accounted for 75 per cent of the exports, gave place to rice and bananas. In Colombia, while much foreign investment has gone into oil and gold, coffee has recently accounted for four-fifths of the exports ; iron ore may still have its day. In Bolivia about three-quarters of export values come from tin, though, as Mr Osborne points out, the country has had little benefit from its mineral wealth in the past and has only a potential for the future. Argentina and Uruguay have depended in the past on the foreign and particularly the British market for their meat.

Manufacturing industry has been late in developing, hampered in the export market by high costs and at home by very low purchasing-power. Argentina has developed industry most rapidly and is the first Latin American country to attain, as it did by 1941, a higher percentage of industrial than of agricultural population. A changing economic structure and a change in politics coincided : industrialisation, the rise of the second generation of immigrants, the coming into power of Peron (1943) and the ' directed economy '. Mr Pendle's book is suggestive here in relating politics to sectional developments, though not always as explicitly as might be. In view of the space he devotes to economic matters in the others of his ' River Plate trilogy ', he has surprisingly little on Argentina's economic problems. In this respect Mr Butland's treatment has better balance and sense of wider relationships. We particularly feel the need for much fuller treatment of industrialisation in the volume on Brazil. At the other extreme in the Latin American range is Paraguay, with very little industry even to-day.

Despite the fact that their resources have so far been beyond their capacity to develop, Latin American States have shown remarkable propensities to grab territory. In this way Bolivia has lost 54 per cent of its original (1825) territory and Ecuador no less than 72 per cent of its original (1740) territory.

Whatever the weaknesses of some of these volumes in treatment, they are without exception rich sources for the general reader avid of curious facts : for instance, that houses were once made of leather in Uruguay ; that Panama hats are really made in Ecuador, where, at Quito, it rains thirteen months in the year and they have four seasons a day ; that potatoes are eaten dehydrated (as *chuño*) in Bolivia. C. J. R.

Le Brésil. By MAURICE LE LANNOU. 6½×4¼. Pp. 224. 12 figures. [Collection Armand Colin, No. 303.] Paris : Librairie Armand Colin, 1955. 200 *Fr.*

M. le Lannou begins his equally compact volume with a systematic account of the relief, climate, soils and vegetation of Brazil. He draws attention to the paradox that almost half of South America should have come under the rule of the Portuguese, originally interested only in slave-run sugar economy on the coastlands in contrast to the quest for the gold of the interior that dominated the Spaniards. The general outlines are followed by a penetrating study of regional development, in which the

solidity of the " vertical " plantation economy of the coastlands is contrasted with the " horizontal " dynamic economy of São Paulo, lying between the mines of Minas Gerais and the prairies of the south. An equilibrium between these regional nuclei of settlement had been attained at the end of the Colonial period, but the political unity under the supremacy of Rio de Janeiro endangered in the latter nineteenth century, was saved by the timely growth of Brazilian national consciousness. M. le Lannou considers that the attainment of stability is still endangered by the continued dominance of the speculative element so characteristic of Brazil's successive economic cycles, by the inadequate constructive investment, especially in the pioneer zones and in transportation, and—a characteristic touch of French geographical thought—by the lack of polycultural family farms. He is outspoken in his consideration of present and future problems and he ends on a note of serious doubt. His book is short but here, within the same compass as the average of the Chatham House series, he has written a systematic study that makes many chapters in the volumes of the latter seem a collection of fragmentary appendices. C. J. R.

HUMAN GEOGRAPHY

Les migrations des peuples. By MAX SORRE. 7½×5. Pp. 261. Paris : Librairie Ernst Flammarion, 1955. 675 *Fr.*

This book is sub-titled an essay on geographical mobility. For the geographer " migrations represent the expression of the mobility of the oecumene ".

The author provides a useful summary of human migrations, ranging from the wanderings of the Dark Ages to the expulsions of the twentieth century. It would be wrong, however, to view the book merely as a digest of facts and figures ; rather are these introduced with the purpose of illustrating the various types of migratory movements. Careful reading will be repaid by a closer understanding of the geographical significance of migration as interpreted by an eminent geographer.

R. H. O.

Ingenieure Bauen die Welt. By KARL KRÜGER. 9¾×7. Pp. 462. 137 photos. 31 maps+1 end map. 33 figures. Berlin : Safan-Verlag, 1955. *DM* 19·80.

Ingenieure Bauen die Welt is a fascinating and well-illustrated account of some of the ways whereby man is making the world a more comfortable place in which to live ; it is in fact an essay in technological geography. By the use of hands and brain man has succeeded in extending the area of civilised settlement, sometimes laboriously, sometimes by leaps and bounds, and the development of techniques enabling him to do this is the subject-matter for an important branch of history. By the middle of the twentieth century, only the very dry and the very cold parts of the world, and the tropics, have resisted the establishment of civilised communities, and this book describes some of the techniques now being employed further to extend the area of settlement ; it covers a wide range of subjects from dam construction and irrigation in desert areas to housing in tropical climates ; soil conservation, transport and even town-planning also have a place. Here, in fact, is an excellent account of the work of " man as a geological agent ", with particular reference to the spectacular changes he is working at the present time. A. MACP.

ROYAL SCOTTISH GEOGRAPHICAL SOCIETY

PROCEEDINGS

OBITUARY : We record with deep regret the death of Samuel Clark Clapperton, Treasurer of the Society, on 12th May 1956, and also of Miss Emma Hall Sawyers, member of Council from 1946-49, on 8th May 1956.

MEETINGS OF COUNCIL were held on 1st May and 24th July 1956.

AWARDS : The Livingstone Medal was awarded to Lt-General John Bagot

Glubb, K.C.B., C.M.G., D.S.O., O.B.E., M.C. (Glubb Pasha) for outstanding services in the cause of progress and stability of the Arab world 1921-56, 1st May 1956.

The Research Medal was awarded to Gerald Roe Crone for work in the field of Cartography and on the history of Geography, 1st May 1956.

The Diploma of Fellowship was awarded to The Reverend Archibald Æneas Robertson, B.D., for special services to the Society and to Scottish topography, 1st May 1956.

DONATIONS

The Council of the Royal Scottish Geographical Society wish to place on record their grateful appreciation of the receipt of intimation of a bequest of £100 under the will of Miss E. Hall Sawyers whose death is recorded above.

ANNUAL GENERAL MEETING

The Annual General Meeting will be held in the Society's Rooms, Edinburgh, on Tuesday, 9th October 1956.

LECTURE SESSION 1955-56

The following lectures were delivered :

EDINBURGH. *Usher Hall.*—Dr Vivian Fuchs and Sir Edmund Hillary on "The Trans-Antarctic Expedition, 1955-58", 3rd April.

GLASGOW. *St Andrew's (Grand) Hall.*—Dr Vivian Fuchs and Sir Edmund Hillary on "The Trans-Antarctic Expedition, 1955-58", 4th April.

Ruhl Restaurant.—Lunch followed by a lecture "Professional Personalities in Glasgow in the early Twentieth Century", by The Hon. Lord Gibson, 24th March.

EXHIBITION OF MAPS OF SCOTLAND, OLD AND NEW

An exhibition to celebrate the 70th Anniversary of the Royal Scottish Geographical Society was opened by the Lord Provost of Glasgow in the Kelvingrove Museum and Art Gallery, Glasgow, on 24th March, for five weeks.

ANNUAL SUMMER EXCURSION

This took the form of a 'Tryst' of 133 members from Glasgow, 37 from Edinburgh, 15 from Dundee and 2 from Aberdeen at a luncheon in the City Hall, Perth, on 26th May. The Lord Provost of Perth attended and welcomed the visitors. The president of the Society, Dr Douglas Allan replied to the welcome and the guest speaker was Professor Wreford Watson of the Department of Geography, Edinburgh University. The tryst concluded with tea at Dunblane Hydro Hotel.

ROYAL SCOTTISH GEOGRAPHICAL SOCIETY TOURS

Switzerland and Northern Italy, May to June 1956.
Austria and Yugoslavia, June and July 1956.

ANNOUNCEMENT

ANNUAL SUBSCRIPTIONS to the Society for EDINBURGH MEMBERS will be raised from 30s. to 35s. per annum from the 1st October 1956.

LIFE MEMBERSHIP SUBSCRIPTIONS FOR ALL CENTRES will be increased from £24 to £30 as from the 1st October 1956, and will be

reducible to £24 (in place of £19) if over 55 or a member for 8 years,
" " £18 (in place of £14) if over 60 or a member for 16 years,
" " £12 (in place of £9) if over 65 or a member for 24 years,

and to proportional amounts between these periods.